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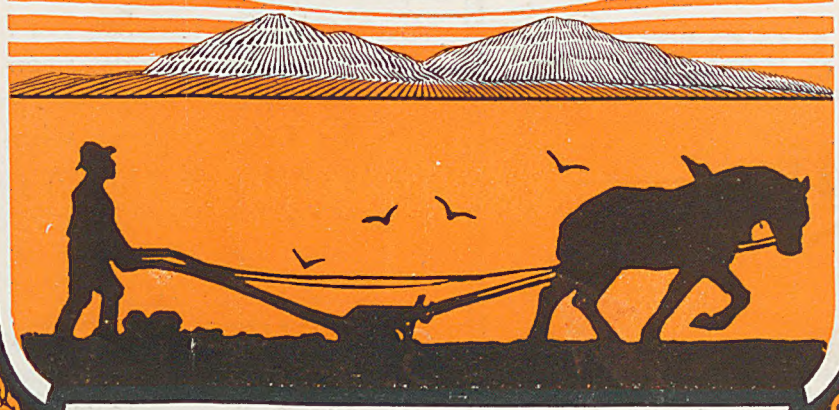
VOL. XXX. PART 7

NATIONAL MUSEUM VICTORIA

The JOURNAL of AGRICULTURE

Of The Department

VICTORIA AUSTRALIA



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Contents.

JULY, 1932.

		PAGE
Camperdown Pasture Trials	*J. E. Harrison, B.Agr.Sc.*	313
Tobacco Growing in East Gippsland	*W. J. B. McDonald, B.Agr.Sc., and G. E. Coghlan*	316
The Sheep Industry—Lamb Marking	*R. N. Wardle, B.V.Sc.*	321
Dairy Farming in the North-East	*W. J. Yuill*	324
Seed Testing	*J. E. Harrison, B.Agr.Sc.*	329
Auction Sale of Tobacco	*W. J. B. McDonald, B.Agr.Sc., and G. E. Coghlan*	333
Tomato Culture—Raising Healthy Seedlings	*A. G. Strickland, M.Agr.Sc.*	336
Winter Irrigation of Vineyards	*F. de Castella*	340
Some Insect Pests of Stone Fruits	*Keighley M. Ward, B.Agr.Sc.*	343
Orchard and Flower Garden	*E. E. Pescott, F.L.S.*	348
Professional Papers—		
Studies of Growth and Fruit Bud Formation	*C. Barnard, M.Sc., and Frank M. Read, M.Agr.Sc.*	349
Rose Diseases and their Control	*B. J. Grieve, M.Sc.*	362

Issued under the direction of the Hon. J. Allan, M.L.A., Minister of Agriculture.

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INDEX TO ADVERTISEMENTS

FRONT SECTION

Buzacott & Coy. Ltd. iv
Dalgety & Coy. Ltd. (Sheep Dip) ... iv
Dalgety & Coy. Ltd. (Tobacco Leaf Auction) v
Ford Motor Coy. of Australia Ltd. ... ix
Foster, R. John L. vi
Gippsland & Northern Co-operative Coy. Ltd. (Separators) v
Hardie, Jas., & Coy. Ltd. x
International Harvester Coy. of Australia ... vii
Leggo, Victor, & Farmers Ltd. vi
London & North-Eastern Railway ... iv
McKay Massey Harris Pty. Ltd. iii
Robur Tea Coy. x
Rosen, L. P., & Son (Fernhill Nurseries) ... v
Trewhella Bros. Pty. Ltd. vi
Victorian Railways ii
Voco Power Kerosene viii

BACK SECTION

Australian Cement Ltd. xiii
Commonwealth Fertilizers & Chemicals Ltd. xix
Commonwealth Savings Bank xvii
Dandy Poultry Food xv
Gippsland & Northern Co-operative Coy. Ltd. (Seeds) xiv
Lysaght Bros. & Coy. Ltd. xvii
Molson, W. E. xvii
Robinson, T., & Coy. Pty. Ltd. xiv
Rylands Bros. (Aust.) Ltd. xiii
Shell Coy. of Australia Ltd. xi
State Savings Bank xv
Texaco Tractor Oil xviii
Victorian Dried Fruits Board ... Cover

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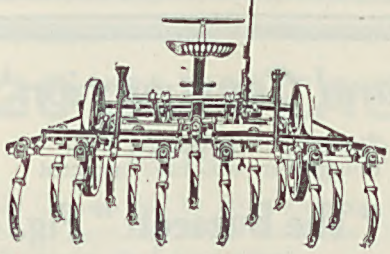

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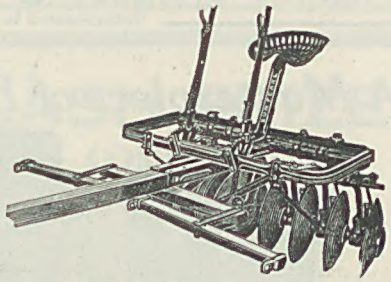

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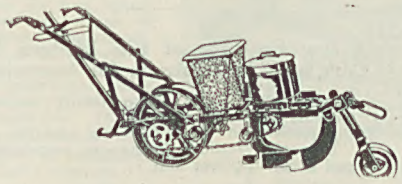

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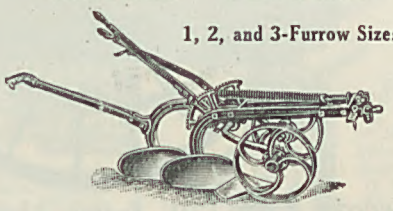

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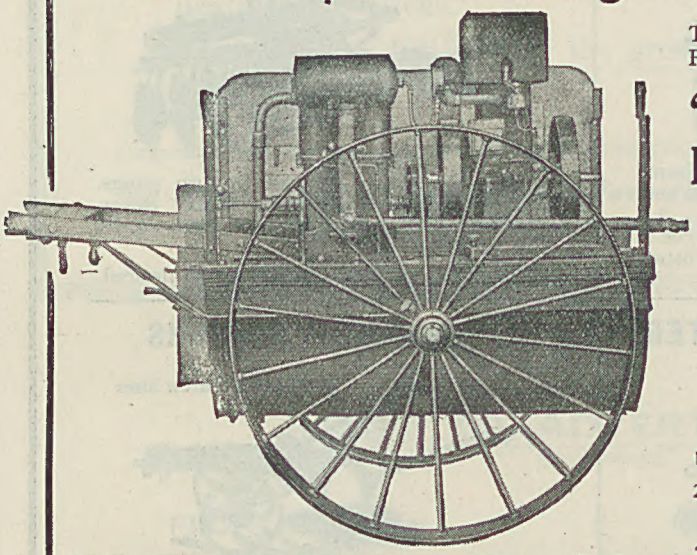

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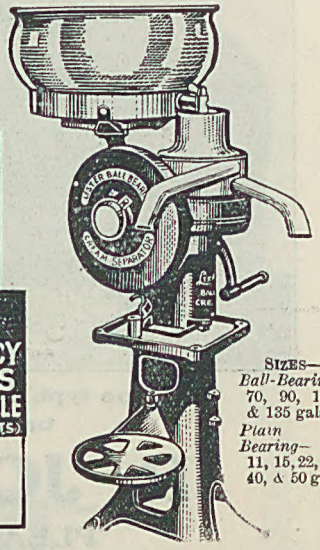

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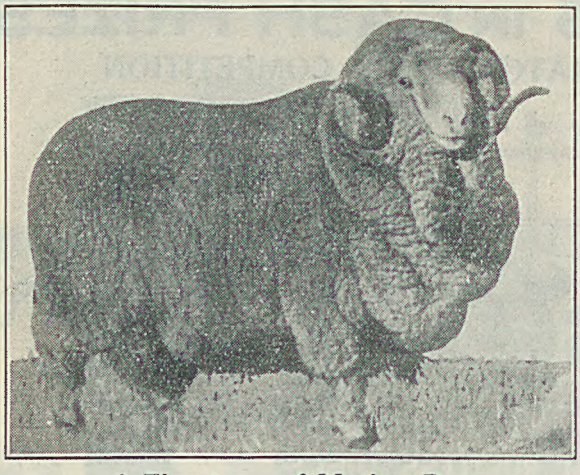

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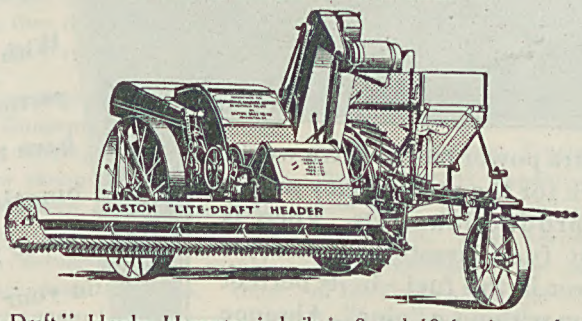

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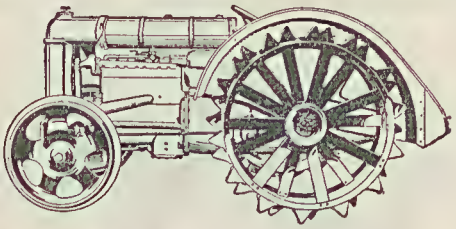

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The Journal of the DEPARTMENT of AGRICULTURE of VICTORIA

Camperdown Pasture Trials

Outline of Tests

By J. E. Harrison, B.Agr.Sc., Senior Agrostologist.

TOWARDS the end of April, 1931, arrangements were made by the Department of Agriculture, through the Camperdown Pastoral and Agricultural Society, for carrying out, on the property of Messrs. Errey Bros., trials of various pasture mixtures and of strains of grasses and clovers.

The site selected for the trials had just grown a crop of potatoes—an excellent preparatory crop for pastures. The land was worked up as the weather permitted, and sown down in the first week in June. Although sowing was late, the soil was in excellent condition, and a good strike was obtained.

The plots, each of which is approximately one-fourth of an acre in area, include trials of the following mixtures:—

Plot No. MIXTURE SOWN.

1. Victorian perennial rye-grass, 20 lb., and white clover, 3 lb. per acre.
2. Imported English rye-grass, 20 lb., and white clover, 3 lb. per acre.
3. Hawkes Bay perennial rye-grass, 20 lb., and white clover, 3 lb. per acre.
4. Victorian perennial rye-grass, 16 lb., and white clover, 3 lb. per acre—to half of this plot Meadow Foxtail was applied at the rate of 8 lb. per acre, while on the other half Phalaris tuberosa was sown at the same rate.
5. New Zealand rye-grass (South Island seed), 20 lb., and white clover, 3 lb. per acre.
6. Irish rye-grass, 20 lb., and white clover, 3 lb. per acre.
7. Control plot—left unsown.
8. Victorian perennial rye-grass, with cross-sections sown to various strains of white clover and cocksfoot.
9. Single rows of various grasses and clovers.

It will be seen that the trials consist mainly of several rye-grasses from various countries. It was decided to use seed of commercial lines only, rather than include a number of selections which, though promising in themselves, are not on the market or available to the farmer. Care was exercised in obtaining seed of known origin, but otherwise it was ordered and taken delivery of in the usual way without any special precautions in respect of its purity and germinating capacity. It was hoped in this way to obtain at least some of the results commonly occurring on farms when pasture seeds are sown down, but, as will be shown subsequently, the trials were rather more complete in this respect than was expected.

The rye-grass trials, being most important, may be considered first. Except in one case a very good strike was obtained, and differences in plant type were easily noticeable within several weeks of sowing. Thus on 7th July it was seen by Mr. Errey that the New Zealand rye-grass (South Island seed) was easily the best. It germinated and grew rapidly, covered the ground well, and looked

most attractive—apparently a pleasing and successful establishment of a rye-grass pasture. One could not suspect that its flourishing nature was based on anything but vigour and permanence or believe that, in its rapid growth, the plant was expressing the characteristics of a quick development and a short life—a fact that became evident later.

Of the remaining rye-grasses, the Hawkes Bay certified line made the best strike, and looked well early in the season. New Zealand rye-grass seed generally is clean and sound. It germinates well, as a rule, and contains few impurities—sometimes, it must be admitted, in contrast to our own. In this latter connexion, however, it might be pointed out that commendable efforts to improve the quality of Victorian seed have been made recently, and these must result in a higher appreciation and improved demand for a worthy product.

The Victorian and Irish lines germinated well, and, in actual appearance, the plants of New Zealand certified, Victorian, and Irish rye-grass differed little from each other. The New Zealand plants were, perhaps, a shade smaller, with finer leaves, and more uniform than the Victorian, while the Irish plants showed a slight lack of vigour in comparison with the other two. Each of the three lots, however, though they came away slowly, would have been regarded as satisfactory under farm conditions. The contrast with the New Zealand South Island lot was very marked, the plants being half the size, and making very slow growth in comparison.

The plot of English rye-grass seed imported from the United Kingdom failed almost completely. There was approximately one seedling per square foot as compared with 70 or 80 in the case of the others. The sample evidently had consisted mainly of dead seed—a fact borne out by laboratory tests subsequently carried out. Of course, it should not be inferred that all rye-grass seed imports from the same source are bad, but here was an instance of what sometimes happens when seed is bought in good faith and sown down with the object of establishing a new pasture. Such failures are not infrequent. The loss to the farmer is considerable, including as it does the cost of the seed and manure, rent of idle land, and the cost of another cultivation. These losses, however, could be avoided by the exercise of more care on the part of the merchant or firm selling the seed. Not all failures are due to inferior seed, but there appears to have been no doubt that such was the cause in this instance, as it is in a large percentage of cases. Thus, in the first season, it is seen that three events happened which occur not uncommonly on farms in the attempt to establish pastures. The New Zealand South Island rye-grass "came away well," making rapid and attractive growth; the Victorian, New Zealand certified, and Irish seed gave good germination, but the plants were small and making slow progress, while the seed imported from England failed completely for all practical purposes.

Observations made on grazing are interesting. The sheep showed a preference for the plot of South Island rye-grass, due, no doubt in the first place, to the larger bite obtainable, but as spring advanced and the other plots made good growth, there was still the same preference shown, evidently because of the tender and succulent nature of this rye-grass. This feature was appreciably noticeable if the leaves were plucked with the fingers. They broke more readily, and felt more brittle than the shorter finer leaves of the other rye-grasses. Otherwise the sheep showed no discrimination, and all other rye-grass plots were grazed equally well.

An inspection in January gave the first indication of the real nature of the majority of plants in the plot of South Island rye-grass. Although mown to prevent re-seeding, the plants had continued to produce stems and flowers, and presented a very dry, stalky appearance, making the plot feel like stubble under foot. Many plants appeared dead, and evidently were actually so in view of the condition of the plot in late autumn, when a heavy mortality had occurred, and the remaining plants were spaced 8 to 10 inches apart. At this last inspection also, about 30 per cent. of the area was covered with capeweed, in marked contrast to the other plots. It was very apparent that the stand was failing. The rye-grass evidently had been a short-lived type, a false perennial as it is described in New Zealand, and quite worthless for sowing down for permanent pasture.

The summer inspection of the other three plots revealed no important differences. They were in the usual summer resting stage, and making no growth. Perhaps the Irish rye-grass looked somewhat less vigorous and robust than the other two, but the difference

was not pronounced, all the swards having a quite dense cover of dry tough herbage.

In the autumn after the first good rains the plots showed rapid growth and, where the rye-grass had persisted, a dense green cover soon overlay the soil. There was an immediate separation of the living dormant plants from the dead remains of the short-lived types. This was most striking in the case of the South Island rye-grass, as explained above, and was very evident also, though to a less degree, in the plot of Irish rye-grass. In both cases a large number of plants had died out, their places being taken by capeweed. In fact, the proportion of capeweed in the plots appeared to be in direct ratio to the number of rye-grass plants which had disappeared. If we sow a poor type of rye-grass, we must expect other plants, usually undesirable, to take their place.

In direct contrast to the South Island and Irish plots were those sown with Victorian and New Zealand certified rye-grass. On both these, swards soon grew dense and long with the very favorable autumn weather experienced this year. There was practically no capeweed in the Victorian plot, thus revealing the persistent nature of the rye-grass and its suitability to the Western District. There was a trace of capeweed in the New Zealand certified rye-grass, which evidently had not stood the summer so well, but the plot was dark green and luxuriant. Unfortunately, Mr. Errey had not sufficient stock on hand to keep the plots closely grazed, and the growth became fairly long and rank, but, as a result, interesting differences in respect of apparent rust resistance revealed themselves. There was a considerable amount of rust over the whole field, but the New Zealand certified and the South Island rye-grass were both definitely less affected than the rest.

The plots have been in existence only a year, and final results have still to be obtained. It is not too soon, however, to relate the results obtained with trials conducted with similar material in the experimental field of the Agrostology Branch of the Department at Burnley Gardens. The stories coincide in all the main features—the short-lived nature of New Zealand South Island rye-grass, the dubious suitability of Irish rye-grass to our conditions, and the persistent, perennial nature of New Zealand certified and Victorian old-pasture rye-grass. It is very clear, so far as our present knowledge will allow us to say, that there are only two lines of perennial rye-grass which may be sown down in Victoria with confidence, namely, New Zealand certified and Victorian old-pasture, and that farmers desirous of introducing perennial rye-grass into their pastures should sow down seed of one or the other. It is inviting failure or, at least, very poor success to employ other lines, and every effort is worth while to secure sound, reliable seed of either of the two recommended.

In plot 4, which was sown to rye-grass and white clover over all, with meadow foxtail and phalaris tuberosa at different ends, the meadow foxtail has not been noticeable so far, but a sprinkling of phalaris plants is now appearing through the rye-grass. In plot 8, in which were included various white clovers, viz., Dutch, Kentish wild white, New Zealand ordinary, and New Zealand wild white, and various cocksfoots, viz., Danish, Akaroa, and Victorian, these plants are thinly present and showing poor establishment.

It is interesting to note the approximate cost of inclusion of seed of these plants in the mixture, viz.:—

Meadow foxtail, 8 lb., at 2s. 6d. = 20s. per acre.
Phalaris tuberosa, 8 lb., at 4s. = 32s. per acre.
Cocksfoot, 15 lb., at 1s. = 15s. per acre.
White clover, 3 lb., at 2s. = 6s. per acre.

Since the rye-grass cost 10s. a bushel, the cost of including either meadow foxtail, phalaris, or cocksfoot was greater in each case than the cost of the rye-grass itself, and so far they have all shown very little promise in this Camperdown plot. The truly perennial rye-grasses have exhibited themselves as extraordinarily dominant over other species, even over white clover, commonly regarded as its natural companion plant. In all plots where the rye-grass has formed a dense sward, the white clover is very thinly distributed, and it is only where the rye-grass has failed that the clover shows any promise of establishing itself. This dominating nature of perennial rye-grass is a problem when it is desired to include other grasses in a mixture. In other trials it has been noticed that only where a thin stand of rye-grass occurs do other species tend to make headway and become an important constituent of a pasture. This suggests that in compounding a mixture some adjustment of the usual proportion of rye-grass to other grasses should be made. Generally 20 lb. of rye-grass is sown with 5 lb. or so of any other grass it is desired to

(*Continued on page 320*)

Tobacco Growing in East Gippsland

By W. J. B. McDonald, B.Agr.Sc., Assistant Inspector of Agriculture, and G. E. Coghlan, Tobacco Expert.

DURING the past twelve months tobacco has been grown in almost every district of Victoria. In many cases the areas planted were obviously unsuited to its successful growth. On the other hand, some of these scattered plots have served to confirm the belief of the writers that a few areas not widely recognized as tobacco-producing districts are eminently suited to the growth of that crop. This applies particularly to portions of East Gippsland, where there are thousands of acres of suitable land concentrated in a relatively compact and fairly well-defined district. The bulk of this land is still uncleared, but a considerable acreage is partially or wholly cleared, and all of it should be available at a very moderate price per acre. In addition, road surfaces are relatively good, and excellent rail facilities are within easy reach. Sheep and cattle-raising, wood-cutting, timber-getting, and a little dairying constitute the present main sources of revenue over the bulk of the district, while more intense dairying and the growth of peas, beans, maize, and potatoes are practised at Wy Yung, the eastern extremity of the district under consideration. Apart from its potentialities as a tobacco-growing district, this area is capable of wonderful development by the application of more modern cultural and pasture practices. The response of cleared land to dressings of superphosphate and the sowing down of subterranean clover is little short of amazing, while the cultivation of maize cereals as fodder crops would ensure a plentiful fodder reserve for the lean period of the year. Excellent butter factories and stock markets exist at both Bairnsdale and Sale, forming a convenient outlet for the dairy produce of the district. Various crops of minor importance, ranging from passion fruit to pumpkins, flourish in various favoured spots. This diversity of possible agricultural products enhances the value of the district from the tobacco-growing aspect. It amplifies the avenues from which farm revenue may be obtained, a real ad-

vantage when dealing with a commodity subject to drastic fluctuations in yield and marketable value.

Agricultural economists agree that greater diversity of operations on individual farms is one of the most effective means of maintaining farm revenue at reasonable levels during a period of depressed prices.

A tobacco plantation in East Gippsland.

With a view to discovering the most suitable areas existing in Gippsland for the cultivation of tobacco, the writers, at the instigation of Mr. H. A. Mullett, B.Agr. Sc., Agricultural Superintendent, last year undertook a rapid but fairly comprehensive survey of that portion of Gippsland lying between Maffra and Orbost. In their opinion the most suitable portion of the area traversed is that which commences at Briagolong on the west and extending through Stockdale, running north of Munro, cutting the main Bairnsdale line at Fernbank, and sweeping northerly round the back of Lindenow, reaches Wy Yung and Sarsfield on the east. This is the district whose potentialities have been discussed above.

A somewhat similar soil formation, without the advantageous climatic feature (for tobacco-growing) of the above district, extends south of the main Bairnsdale line and the Prince's Highway about Hillside, reaching as far as Bengworden. Conditions here are distinctly colder, windier, and drier than those further north. Reference to the accompanying map will aid in locating the areas under discussion. The average annual rainfall over the district varies from 25 inches in the south to 30 inches in the north. Although the annual fall is not high, the summer precipitation is fairly generous, August being the driest month of the year.

The average rainfall during the growing period, October to March, varies from 13 inches to 16 inches. This compares favorably with the rainfall for Myrtleford, the centre of the north-eastern tobacco-growing district, which approximates 12 inches for the same period. On the other hand, the January and February temperature averages of this portion of Gippsland are from 3° to 5° lower than those holding in the north-east. The mean daily temperatures at Bairnsdale from November to March are as follow:—November, 60.3° F.; December, 63.5° F.; January, 65.0° F.; February, 62.0° F.; and March, 62.0° F. These temperatures are slightly below those best suited to tobacco-growing, but it is generally claimed throughout the district that the timbered country under discussion is possessed of a warmer and more equable climate than the township of Bairnsdale. Unfortunately, the meteorological data necessary for the confirmation of this point are not available.

Average Rainfall, October to March.

Station.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total.
	points.	points.	points.	points.	points.	points.	points.
Pomonal ..	240	203	164	100	127	146	980
Myrtleford	195	218	230	175	154	249	1,221
Stratford ..	276	218	223	200	217	248	1,382
Sale ..	361	268	256	208	175	268	1,536
Bairnsdale	249	184	209	282	191	254	1,369
Fernbank ..	237	187	196	285	195	249	1,349
G. C. Dunsmuir's farm, Stockdale (6 yrs. only)	359	201	181	129	221	356	1,447
Lindenow ..	279	188	206	251	170	233	1,327

The accompanying table shows the average fall for the months from October to March

Mr. T. Prowd, of Briagolong, planting out.

over a long period of years for various stations in close proximity to the area, and also for Myrtleford in the north-east and Pomonal near Stawell. It will be observed that the summer rainfall averages a little more than 2 inches per month, and is slightly higher than at Myrtleford and Pomonal. For the purposes of this article, the district under discussion may be divided into two portions, the largest being that portion of the area shaded on the accompanying map and lying west of the Mitchell River. This portion is intersected by a watercourse known as Providence Ponds. The smaller comprises the parishes of Wy Yung and Sarsfield.

In the larger or Providence Ponds portion thousands of acres apparently suitable for tobacco-growing are at present under tall timber and bracken fern. The actual area that probably could be planted to tobacco would be limited by the amount of wind protection afforded, but is probably well in excess of 10,000 acres. The northern and most suitable portion of this area is comprised mostly of bracken-covered ridges running in an easterly and westerly direction. While many small portions of this country and a few relatively larger areas are already cleared, the bulk of it is either under dry or green standing timber or covered with bracken.

Generally speaking, the soil is a light sandy loam, which at a depth of 6 inches merges into a reddish or brown sand, which in turn gives place at about 20 inches to whitish-coloured sand overlying yellow clay at about 30 inches. Naturally the depth of the various soil formations varies considerably, but only in relatively small areas is the clay close to the surface. Over all this district superphosphate is an essential aid to successful crop production. Occasionally quartz or ironstone ridges appear. These, of course, are not suited to cultivation.

The bulk of the timber is stringy-bark, silver-top, and silver wattle, with yellow-box, apple-box, and iron-bark appearing in lesser quantities. The silver-top and silver wattle country, perhaps, is best suited to tobacco-growing, whereas the iron-bark ridges are definitely unsuitable.

The cost of clearing this virgin country is high, varying from £10 to £15 per acre, although where the timber has previously been

A portion of Mr. Prowd's Crop at Briagolong.

rung or killed by poisoning, it could be cleared at from £3 15s. to £5 per acre. Poisoning prior to grubbing should be the cheapest method of clearing. Poisoning destroys the root hold, and as the soil is naturally friable and loose, surprisingly large trees can then be pulled out with the aid of a forest devil or some similar mechanical means.

This country yields much better crops if, after clearing, it is left in fallow for some months. Intensive cultivation should succeed clearing in order to destroy and keep the bracken in check. If neglected for any length of time the land rapidly reverts to a condition requiring considerable further expenditure in re-clearing. A vigorous-growing shrub known locally as manuka rapidly takes possession of forest land which has been cleared and neglected. The work required in shaping a farm out of this type of virgin country is arduous and constant, but it is felt that success would eventually reward the persistent settler.

In the Wy Yung and Sarsfield area 20 to 30 square miles of country of which from 4,000 to 5,000 acres are suitable for tobacco represent a compact little district lying a few miles north of Bairnsdale, and served by excellent main roads. It is comprised of hills and gullies covered with stringy-bark and bracken with wattle in isolated patches. The bulk of it is uncleared, the small cleared areas being sown mainly to peas and beans.

The soil is a fine-textured grey sand to 9 inches overlying light yellowish sand to 20 inches or more when a sandstone formation is encountered. Possibly the soil has more productive capacity than that typical of the Providence Ponds area. Cleared land is said to be available at about £13 per acre, dead-timbered land at about £7 per acre, and green-timbered land at about £1 per acre. Land on which the timber has been rung or poisoned can be cleared for from £3 15s. to £4 per acre, while the clearing of green-timbered country would cost about £12 per acre.

In every recognized tobacco-growing district variations in soil type, together with the location of a particular site in relation to sun, wind, and water, combine to make certain spots more suitable to tobacco than others. This holds true also for Gippsland, and although there is no scarcity of such suitable spots, it behoves the prospective grower to exercise care in selecting a site for the crop. "Spewey" or ill-drained areas should be avoided, and care taken to utilize natural facilities in the form of standing timber or hilly country as a wind-break. Warmth is all important to tobacco, and the sunny side of a slope is usually that most favorable to its growth. Low-lying pockets, which may be liable to severe or early frosts, must be avoided.

Gullies in which moisture-laden air is liable to stagnate for a lengthy period are possibly more favorable to the spread of blue mould than are slopes on which the air is more constantly moving and in which more effective air drainage thus occurs.

Some confirmation of the favorable impression gained on the original tour of this district has been provided by several good tobacco crops grown by farmers at Briagolong, Stockdale, Fernbank, Wy Yung, and Clifton. Although in some instances lack of experience in curing the leaf will detract from the value of the ultimate product, indications are that ordinarily experienced curers would produce a high percentage of bright leaf of silky texture. Mr. T. Prowd, of Briagolong, who has been growing tobacco for two years, expects to market from 6 to 8 tons of leaf from an area of 12 acres. The percentage of dark leaf in this crop is negligible. Despite the abnormally dry summer, a plot of tobacco grown by Mr. G. C. Dunsmuir, of Stockdale, and kept under continual observation by the writers, exhibited no signs of retarded growth due to droughty conditions. At no stage of the summer was the soil dry to a greater depth

A seed-bed in the forest.

than 2 to 3 inches, despite the lack of irrigation facilities.

Unfortunately, Gippsland is quite as subject to blue mould as is the rest of the State, and Mr. Dunsmuir's crop suffered severely from this scourge. A conservative estimate would place the unaffected portion of his crop as yielding at least 800 lb. per acre of cured leaf of excellent colour and texture. Blue mould is the only serious deterrent to the production in this district of the type of tobacco that should appeal to the smoking public. Mr. H. Gratton, at Wy Yung, has a small but impressive bulk of bright leaf, while Mr. F. Loud, at Clifton, has some very creditable colours in the produce from his 8 acres of crop.

With more favorable seasons and greater experience on the part of the growers, it is confidently predicted that the quality and quantity of this year's crop will be greatly exceeded in future seasons.

With one exception all the kilns in this district are built of logs and mud, and have proved neat and effective structures. Mr. Dunsmuir constructed a very efficient double-walled kiln by building the first 6 feet out of slabs, the intervening space being filled with earth. The upper walls were lined inside and out with sheets of bark, with the rough side inwards, and the space between the double walls was filled with sawdust. All kilns are fitted at 5 feet from ground level with a floor made of saplings. The ease with which the barn can be filled is thus greatly facilitated.

Much advice could be given to the prospective tobacco-grower, especially those who may contemplate going into uncleared country, but unless he be possessed of two essential characteristics he is doomed to disappointment. The first is a fondness for or easy toleration of the bush; the second is any amount of grit and capacity for hard work.

Camperdown Pasture Trials

(*Continued from page* 315.)

include, but the Camperdown trials indicate that experimental work is necessary to determine those proportions which should be used in order to secure the proper development of other components and secure a balance between rye-grass and phalaris, or cocksfoot, as the case may be. Such a trial is proposed, and it is expected to be undertaken this season with an early spring sowing.

Plot 7 was left unsown as a control in order to see what volunteer growth occurred and might affect the various other plots. It is known that rye-grass and subterranean clover gradually establish themselves in many Western District fields left to revert to volunteer growth after cultivation, and it was necessary therefore to see to what extent they were present in the experimental field. So far, however, practically no rye-grass has appeared, and only odd plants of sub-clover are noticeable. In the first season winter grass (*Poa annua*) was the sole colonizer. It occurred freely also on the sown plots, but ultimately was thoroughly suppressed there by the rye-grass. In view of the re-seeding which must have taken place on plot 7, left unsown, it was thought that it would occur there again this season, but it has been completely displaced by a bank of capeweed, as dense as it can grow and about 15 inches high. It has been mentioned that capeweed has appeared in the plots where the rye-grass failed or thinned out. Where it has persisted, however, it has stood out against even this aggressive invader, affording further evidence of the remarkable capacity of perennial rye-grass under the soil and climatic conditions of this experiment to hold its own and crowd out such would-be competitors.

The single rows of various species of grasses and clovers sown in plot 9 were sown a foot apart, and as it was not practicable to keep them weeded, all with the exception of a few tall-growing species, fog grass, and the invincible perennial rye-grass, were mainly suppressed by the weeds which sprang up between the rows.

The Sheep Industry

Helpful Hints to Sheep-men

2.—Lamb Marking.

By R. N. Wardle, B.V.Sc., Veterinary Officer

[The first article of this series, which appeared in the June issue of the Journal, dealt with the selection of ewes and rams.]

THE question of lamb marking and of the precautions to be taken to ensure the successful carrying out of that operation is one deserving the serious consideration of all sheep-breeders. That adequate precautions are not always taken is evidenced by the large percentages of lambs so frequently lost after marking. It is the object of this article to set out a few hints that, if carried out, should reduce materially the loss of lambs from this cause.

Much of the success of sheep-farming depends on the percentage of lambs reared, and an 85 per cent. drop has much of the gilt taken off when reduced to, say, 70 per cent. after marking.

Lamb marking consists of three operations, ear-marking, castration and docking, which are performed in that order. In this article, however, it is proposed to deal only with castration and docking.

Age and Time for Marking.

Strong lambs can be safely marked any time after they are a few days old, but when dealing with numbers a good time is when the majority are about two or three weeks of age.

A period of mild weather should be chosen. Windy days are most unsuitable, especially if the wind be cold and piercing. Marking operations should never be carried out during hot weather. Even in mild weather it is best to carry out the work in the morning and early afternoon only. By finishing up early there is a better prospect of all the lambs being mothered before evening. This in itself will save many a lamb that would otherwise die.

Where the Work Should be Done.

Temporary pens and yards, erected out in the paddocks where the lambs are actually living, form the ideal site. These may be constructed simply by the use of hurdles, stout stakes, and wire netting. Temporary yards for small flocks can be constructed with surprisingly little trouble, and even when dealing with large numbers it pays to mark the lambs in temporary yards, though in such cases they necessarily have to be more complicated.

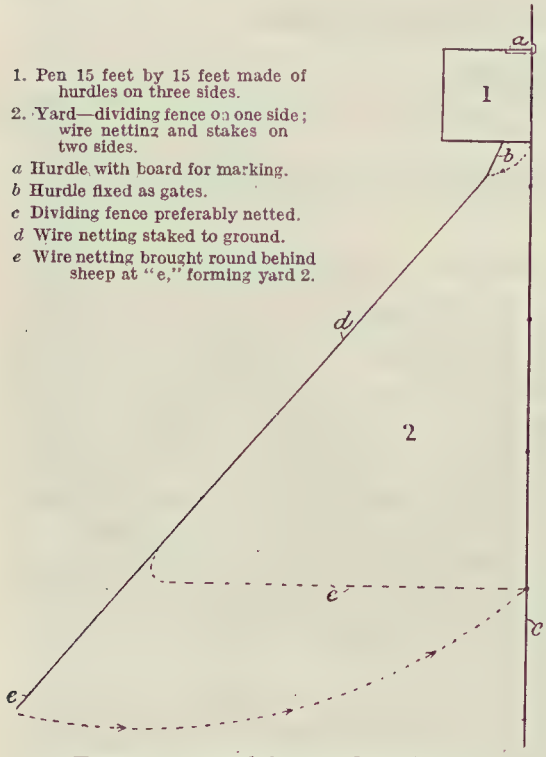
The yards should be dismantled when the job is finished, and in the following season a fresh piece of ground should be selected for the site.

A plan of yards to hold about 250 ewes and their lambs is reproduced in the accompanying sketch.

The advantages of using such a site are many and will bear much consideration. The lambs will not be hot and fatigued before or after the operations. This is important, since fatigue lowers the resistance of the animal body to climatic changes and bacterial or germ infections. Again, they will be placed on clean grass land instead of on broken up ground, soiled by manure, such as is found around old yards; consequently, the risk of contamination of the wounds is practically nil. A third advantage previously mentioned is that if the work is completed early in the afternoon, the ewes and lambs being in a paddock they know, will find each other more readily.

If, however, it is necessary to use the permanent yards some preparations are needed to make them as clean as possible. All manure and rubbish should be carted away

to a safe place and the yards watered to lay the dust. The place of operation should be selected so that, if possible, the lambs may be dropped into a grass paddock and not into a yard. The posts and rails adjacent to the operating site should be cleaned up with an adze.


1. Pen 15 feet by 15 feet made of hurdles on three sides.
2. Yard—dividing fence on one side; wire netting and stakes on two sides.
a Hurdle with board for marking.
b Hurdle fixed as gates.
c Dividing fence preferably netted.
d Wire netting staked to ground.
e Wire netting brought round behind sheep at "e," forming yard 2.
a
1
b
d
2
c
e

Temporary yard for marking lambs.
Will hold 250 ewes and their lambs—scale, 1 inch equals 35 feet.

Wherever the operation is performed a new board such as a 6-in. flooring board should be nailed on to the top rail and used instead of the rail itself. A sheep skin or other covering is quite unnecessary and dangerous.

The board should be kept clean during the day by scrubbing it with a solution of washing soda in hot water, and a new board should be used each season.

The clothes not only of the operator but also of the catcher should be as clean as practicable. The lamb should be sat on the board, care being taken to treat it as gently as possible. The hind legs should not be pulled too far apart, and after the operation is completed the lamb should be dropped gently on to its feet.

The Operation of Castration.

The lamb is picked up and placed on its rump on the board, each hind leg being held with its corresponding front leg, the back of the lamb resting against the chest of the holder. Care should be taken that the hind legs are not held too far apart nor should the lamb be treated roughly in any way.

The operator then grasps the tip of the scrotum or purse in his left hand, and with the knife blade completely severs the lower one-third. This method has advantages over the practice of simply slitting the purse with two incisions through which the testes are removed. The former method is simpler and quicker, and there is less likely to be any suppuration or collection of a blood clot.

As soon as the scrotum is opened the fingers of the left hand are placed behind the testicles, and by pressure they are forced out of the purse and can be seized; then by using just sufficient traction to operate behind the organ one by one the testicles are drawn out, and the cord severed.

There are many variations of the method used for severing the cord. The old method of using the teeth to grasp the testicle and drag it out has in general been superseded by the use of an instrument in the form of a pair of toothed grips, but, from a surgical point of view, this method is not the best, as very often considerable force is necessary, and the cord may break high up. Such happenings must have a bad effect on the lamb's recovery from the effects of the operation. Often the knife only is used and the cord severed by a series of scraping movements.

One of the neatest and most surgical-like ways is to use an emasculator which severs the cord and crushes the severed end. Seldom is there any haemorrhage and larger lambs are very successfully operated on by this method. In every case where an instrument is used each of the testicles should be treated separately.

The Bloodless Operation.—There is a method by which the male lamb can be castrated without making a wound in the scrotum. A pair of very strong specially constructed pincers which sever the cord inside the scrotum are used. Each cord is done separately. The jaws of the castrators or pincers are brought together over the skin of the scrotum with the cord lying in between, and the handles are squeezed to their limit and opened. The

severed ends of the cord can then be felt. This operation is repeated for the second testicle. The severed organs atrophy or wither.

Some flock-owners who have had experience with this instrument state that lambs so marked thrive better than those treated by the usual open methods where there are external wounds to heal, and probably more shock. In fly-infested districts or on properties known to be infected with tetanus or other disease-producing organisms, these instruments would be invaluable.

Sterilization of Instruments.

Knives used should consist of metal wholly so that they can be effectually sterilized. The best and surest method of sterilization of instruments is by boiling in water for fifteen minutes, and all instruments other than knives should be so treated. Continual boiling effects the cutting edge of the latter, so the practice adopted is to sharpen them, wipe clean and then soak in and rub them over with methylated spirits.

But sterilization in the first instance is of little use if, subsequently, the instruments cannot be maintained sterile. Hence, when not in actual use they should be kept in an antiseptic solution. This can be done by using a small clean and fairly flat dish (one cut out of a petrol tin will do) arranged so that it can be fastened to a post. In this receptacle some lysol preparation of a strength of one tablespoonful to one pint of water should be kept.

The instruments should be constantly dipped in this solution and when not actually in use they should be kept in the dish. The practice of placing the instruments anywhere except in an antiseptic solution is to be strongly condemned. If by any mischance an instrument should be soiled by dirt, the original process of sterilization must be carried out.

The operator should have water, soap, antiseptic, and a nail brush always convenient to use for washing his hands, and he should not attempt to assist at any other work.

Docking.

In docking the same pracautions are necessary with respect to the knives used. The tail is cut off generally about the second joint. Before it is actually cut the skin should be retracted slightly towards the lamb's body by the man holding the lamb. When released it projects over the end of the bone, protecting it while healing takes place.

The pincers mentioned for the operation of bloodless castration may also be used for docking. The jaws are brought together at the required position, and as this does not completely sever the tail, it is then necessary to complete the operation by running the knife around the inside curve of the jaws of the instrument; the edges of the skin then remain together.

If the process of marking be carried out in a clean manner and the lambs placed on clean pasture after the operation, dressings are superfluous. Sticky dressings that hold dust and dirt are actually harmful.

Wound Infection.

Tetanus or lockjaw is the disease causing the greatest loss in lambs as the result of wound infection. Symptoms show in from two to fourteen days after infection and are as follow:—

The lamb becomes stiff in the legs and while it can walk it shuffles along with more or less straight legs. On handling it is found that the body also is stiff and the muscles of the back and loins are hard. Later, the lamb falls down and lies in a characteristic attitude with legs outstretched and the neck drawn back. If lifted and held on its feet it is seen that the limbs remain rigid and are placed outwards from the body, the attitude simulating a trestle.

Tetanus is not a blood poisoning, but the symptoms are due to a poison affecting the nervous system. Tetanus germs form spores or seeds, and it is the spore which contaminates the wound. These spores are extremely resistant to destruction and can live in soil and manure for a great length of time.

Losses are brought about also by blood-poisoning, and there may be several different kinds of germs causing this complaint. Death generally occurs rapidly and the main point for notice is the fact that, like the tetanus infection, the germs of blood-poisoning inhabit manure, dust and soil.

Infectious arthritis (*inflammation of joints*) sometimes occurs in lambs after marking, and is characterized by lameness in one or more legs. Often no lesion is noticed, but possibly, in virulent infections, swelling and heat in the joints may be noted.

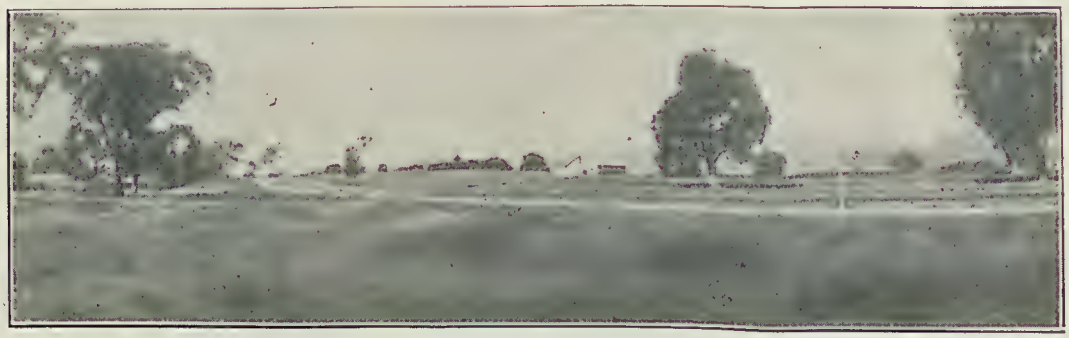
In the majority of cases lameness which passes off after a few days is the only symptom,

(*Continued on page* 328)

Dairy Farming in the North-east

Striking Developments at Myrtleford

By W. J. Yuill, Senior Dairy Supervisor.



Typical Kiewa Flats.

ALTHOUGH much of the north-eastern portion of this State is steep mountainous country, carrying poor timber and sparse herbage, the river flats and the valleys, and in some cases the foothills, are extremely fertile. In some of the upper reaches in the so-called snow country, there is good grazing during summer and autumn. Claims that these areas are to be considered among the best dairying areas of the State are usually admitted, but rarely appreciated.

The main headwater system of the Goulburn River is in the Yea-Alexandra-Mansfield districts. Here innumerable creeks and valleys make into the Acheron, the Delatite, the Rubicon, and the Taggerty Rivers, and thence to the Goulburn, and along all these streams there are a great many dairy farms. At Benalla, on the Broken River, and back into the steep hill country, there is similar land, particularly in the Lima, Tatong, and Swanpool areas.

The great valley of the Murray stretches away beyond Corryong to the place where it is lost in the Swampy and Little Rivers, which in turn are fed by innumerable springs and creeks from the snow country around Mount Kosciusko. The country in the vicinity of large creeks like the Cudgewa, Nariel, and Thougla forms a well-known dairying area, which supplies large quantities of cream to the Walwa-Jingellic, and the Upper Murray butter factories.

The main valley of the Mitta Mitta River, so widely famed for its fertility, is about 50 miles long. Indeed, from where it joins the Murray just above the Hume Weir to the head of some of its tributaries, the distance is nearer 60, or perhaps 70 miles.

Above Tallangatta, and along the Tallangatta Creek, are to be found some splendid farms. At Eskdale, the Little Snowy runs back into the hills for more than 10 miles; a little lower down the Scrubby Creek comes into the Mitta from several miles of valley. At the end of the main valley lies the little township of Mitta Mitta—a relic of past mining days. All along the main stream, and in the valleys of its tributaries, are the farms of the shareholders of the Eskdale and Tallangatta butter factories.

The Kiewa Valley is one of the best in the State. From the foothills where it rises to the place where it joins the Murray below the Hume weir is a distance of 40 miles. In this area are some of the best dairy farms and herds in Victoria.

Herd Testing Development.

Although in the Ovens and the King valleys a great deal of tobacco, hops, broom, and millett are grown, there is a very high proportion of dairying properties. It is doubtful if any area has shown greater improvement in

dairying than has been accomplished at Myrtleford since the inauguration of the Herd Testing Association some seven years ago.

During the year 1930-1, eleven associations in Victoria showed an increased return of 100 lb. of butter-fat, or more per cow over their best figures of pre-testing days.

Among this number were Myrtleford No. 1, Walwa, and Eskdale No. 1, with an increase of 98 lb., Moyhu with 89 lb., and Tallangatta No. 1 with 77 lb. All showed considerable improvement. The figures given below prove a general increase during the three years ended 1930-31.

These statistics indicate the results that follow from care in breeding and from culling and feeding; for more heifers are now being milked than previously; yet the yield per cow in quantity and quality has never been higher. Of the herds throughout this portion of the State being tested by Herd Testing Associations, 103 herds, or 22 per cent., exceeded the 300 lb. standard. Over 300 cows exceeded the 400 lb. butter-fat mark. Of this number 23 yielded over 500 lb.; 3 over 600 lb.; and one topped the 700 lb. mark. Some 243, or 5.3 per cent. of the 3-year-olds tested yielded 300 lb. or more butter-fat; and 116 2-year-olds, or 2.5 per cent., produced better than 300 lb.

Such figures prove the potentialities of the north-east for dairying, and suggest the possibility of further development.

Results at Myrtleford.

Following upon the return of the troops from the Great War in 1919, several estates were cut up for soldier settlement in the Myrtleford-Whorouly area, including the Happy Valley, Merniyong, and Mudgegonga properties. Very definite success has been achieved by some of the settlers on these estates. This is particularly true of those men who have applied modern methods of herd testing, pasture management and fodder conservation, in the place of the antiquated system of dairying with cows of unknown producing ability, inadequate feed supplies, and worn-out pastures. A few settlers sometimes attempt to grow catch crops like tobacco, broom, &c., with the common result that both the crop and the herd suffer. These are the days of specialists. Each type of work calls for a thoroughly equipped farm, and an intelligent operator. Probably dairying is the most stable of all our industries, and wherever modern methods are followed, definite progress is made.

Effect of Herd Testing.

It is an interesting fact that, prior to the inauguration of the Myrtleford Herd Testing Association, very little progress was made in the industry. This fact is reflected in the following table:—

Year.	Cows.	Average Yield Butter-fat.	Total Butter-fat.
		lb.	lb.
1924–5	672	174	117,450
1930–31	635	277.2	176,022

Last year, 37 less cows were milked than the number milked seven years before, yet 26 more tons of butter-fat was delivered at the factory. The increase in the average yield per cow was 103 lb.

There are now three units operating in the district, and much thanks is due to Mr. Crameri and to Mr. C. C. Johnson and other pioneers who were responsible for the introduction of herd testing to the district.

Some Outstanding Successes.

Mr. Kneebone's six cows averaged 503 lb. butter-fat. This is a sterling record for six grade cows. The result is equal to the return from a herd of more than 20 cows in many parts of Australia, for the average for the Commonwealth is approximately 140 lb.

HERD TEST RESULTS—NORTH-EAST DISTRICT.

Year.	Units.	Herds.	Cows.	Heifers.	Pure Bulls.	Lb.		
						Milk.	Percentage.	Butter-fat.
				%	%			
1927–8	12	264	8,569	27	57	4,075	4·73	192·5
1930–31	20	470	14,172	32	75	5,309	4·68	248

Probably the outstanding herd of its size in Australia was that of Mr. Don Browne. It consisted of 48 Jersey grade cows, which, without any allowances, averaged 417 lb. butter-fat. (This was the yield according to the Association records; the factory returns also showed it to be over 400 lb.)

Mr. D. Browne's Jersey Bull, "Springhurst North Star."

It is interesting to note that, with the exception of six junior 2-year-olds, all the members of the herd were sired by "Jessie 15th Handsome Boy of Melrose." The herd has been bred from Shorthorns, and each cow is a big, deep-bodied, robust animal. Mr. Browne's farm has an area of 250 acres; 165 acres consists of good flats, the remainder being very light hill land. Approximately 140 acres have been top-dressed, 23 acres of oats are grown for winter feed, and 9 acres of Sudan grass for summer fodder.

The pastures were sown with a heavy seeding. The mixture was 2 bushels perennial rye, 10 lb. cocksfoot, and 1 lb. each of white Dutch, cow grass, and Alsyke clover.

As on many other farms, it has been found that certain families perform more consistently than others as producers; some are shy breeders, some rarely fail to leave good progeny, &c.

An illustration of the passing on of the production character is seen in the Roanie family. The original "Roanie" died during the first testing year. Her record was 350 lb. butter-fat in 180 days, or nearly 2 lb. a day for five months. "Roanie II." "Red Roan," "Snook," and "Roanie III." are daughters of Roanie, and produced as follows:—

Roanie II.	273 days	528 lb. butter-fat
Red Roan	273 „	527 „
Snook	273 „	400 „

Roanie III. proved to be unsatisfactory and was culled.

Mr. Browne and his wife control the whole of the milking operations, which is done by machines. The condition of the sheds, yards, and dairy buildings was a tribute to the high standard set by the owners. The machines are cleansed daily with the caustic soda solution, and plenty of hot water.

A little bran was fed to the cows throughout the whole of the milking season.

Plans are in hand for further subdivision of the farm for the more effective control of the pasture.

A Fine Achievement.

Mr. C. C. Johnson is widely known as a councillor of the Victorian Utility Cow Testing Association. He also represents his riding in the Myrtleford Shire Council, and like Mr. Browne, is a director of the local butter factory.

Few men in Victoria can claim to have made such progress. The following table unfolds a splendid story of herd and farm development:—

Year.	Cows Milked.	Average Butter-fat with Allowances for Heifers.
		lb.
1926–7	27	187
1927–8	32	242
1928–9	37	300
1929–30	47	342
1930–31	52	351
1932–2	Milking 60 cows	

All this has been achieved on 250 acres of light land that originally would not sustain a small herd of 27 cows. Now 100 acres are annually cropped to wheat and barley. Half the crop is used by the farm stock mainly for pig feed.

From 30 to 40 tons of super. are used annually on this farm. Various mixtures of pastures have been tried, the most satisfactory being perennial rye, 1½ bushels; cocksfoot, ½ bushel; and 2 lb. each of Dutch white, cow

grass, alsyke, and subterranean clover. Mr. Johnson favours this very heavy seeding, as it provides a thick pasture in the first year. Twenty-five acres of Hunter River lucerne is grown; three cuts were taken off last year without irrigation. A hillside pit silo 35 feet x 15 feet x 11 feet depth has been built. It contains at present the first cut lucerne from 25 acres, sown pasture from 10 acres, subterranean clover from 5 acres, and shandy hay from 8 acres cut in the early hay stage.

In filling this pit silo Mr. Johnson aims to get in about 7 feet daily. A ¾-in. pipe is inserted into the ensiled mass, and a thermometer let into it. By this means the temperatures can be observed. As fresh material is added, the temperature falls, and filling operations are stayed; then gradually it rises to 110 degrees or to 115

Mr. D. Browne's "Springhurst Baupinia"—Yield, 494 lb. butter-fat.

degrees F., and filling is resumed. It takes about fourteen days to fill the silo, and by this time the material is some 7 or 8 feet higher than the surface. After sealing down with earth, the mass sinks till it is a little above the earth level. On the occasion of my last visit to Mr. Johnson's farm, he had as reserves five stacks of grass hay, containing about 80 tons, and approximately 25 tons of oaten hay.

The splendidly equipped pig-sheds and pig-yards (all painted) are worth going a long way to see. The twelve sows and three boars which constitute the pure stud of Large White pigs were all bred from imported stock.

There is a keen demand for stock from this stud, and all of Mr. Johnson's clients are satisfied ones. His custom of replacing unsatisfactory stock has gained for him many clients.

An average litter numbers ten. All marketed pigs are first grazed in small paddocks, and finished off on self-feeders. A half-and-half mixture of crushed wheat and barley is used, to which 1 per cent. of air-slaked lime is added. As much charcoal is given as the young pigs will eat.

If calves are not well grown during their first year they receive a check from which they never fully recover, is Mr. Johnson's practical deduction from many years of calf feeding. Every effort is made to keep the calves growing to their maximum during their first nine months.

Many breeders and judges are so obsessed with the idea of fineness in stock that they err on the side of under-feeding in order to secure this result.

Dairy animals that are to make profits on a commercial dairy farm need to be well-grown if they are to produce and reproduce.

Well-grown yearlings can be put out in the hill country, and suffer no check in growth. Mr. Johnson brings his two-year-old heifers to the home farm about two months prior to their calving, and feeds them liberally.

A son of "Carnation Fox," imported, has produced some splendid deep-bodied roomy cows, and their yield of butter-fat is approximately 50 lb. higher than that of their dams. "Alloy of Banyule," ex "Velveteen 4th," by "Ingot of Banyule," increased the average production of his daughters by a similar amount. In the early stage of herd-testing, a very costly error was made. One of the herd cows tested only 3 per cent., and as this was deemed to be very unsatisfactory, she was speyed. Subsequently it was found that her yield would have been heavy. Her daughters are outstanding producers, as indicated below:—

Norma	Mature	273 days, 456 lb. butter-fat
Freshia	J. 2 yrs.	350 lb.; as a S. 2 yrs. 412 lb. butter-fat
Mena II.	J. 2 yrs.	327 lb.; as a S. 2 yrs. 423 lb. butter-fat
Mena III.	J 2 yrs.	300 lb.

Other Myrtleford Farms.

On the well-managed farms, at Whorouly, of Mr. R. Boyd and the late Mr. T. Taylor, Friesians have proved to be good yielders.

Mr. Taylor's farm of 235 acres carries up to 40 milkers. The highest yielder is "Black

Queenie." Her records during the past three years were 451, 450, and 438 lb. of butter-fat. A 3-year-old heifer from this cow produced 408 lb. butter-fat.

In the first test year, 24 cows averaged 186 lb. The herd average during 1930-31 was 308 lb. butter-fat. The first bull used was "Bolebek Mayne," ex "Bolebek May." He was followed by "Barome Royal Hero," a son of "Bolebek Mayne." The present herd sire is "Bolobek Aaron," ex "Bolebek Ann," a 640 lb. butter-fat cow. His sire was "Matador Hyland Segis."

A pure stud of Large White pigs is being developed. Some Large White Mid-white first-cross sows are being bred back to the large white boar. The progeny are making 150 lb. baconers in six months.

The main ration consists of crushed barley fed through self-feeders, with skim milk. An area of 45 acres is cropped annually to barley and oats. The grass mixture sown is 20 lb. perennial rye, 20 lb. cocksfoot, 1 lb. each of Dutch white, cow-grass, or red clover, and Alsyke. Pastures receive a bag of super. per acre annually. About 10 acres of Italian rye is reserved as a hay crop in the first year; in subsequent years it is grazed. For summer feeding, Japanese millet is favoured; 15 lb. of seed and 140 lb. super are used per acre.

Mr. R. Boyd's herd sire is also a son of "Matador Hyland Segis." He is from "Bolobek Mermaid," whose dam averaged 520 lb. for three years. The herd of Friesian grades and pure stock consists of fine, even, well-developed animals. It is mainly pasture-fed. The pastures receive from 1 cwt. to a bag of super. annually.

The farm is of 129 acres, only 80 acres of which are used for dairying. Up to 30 cows are kept. The herd average, including juniors, is now 359 lb. per cow.

The leading family is from Daisy, a 354 lb. cow—as shown below:—

Black Daisy	Mature	360 lb.	butter-fat	273 days
Black Rose ..	,,	389	,,	273 ,,
Young Rose	J. 2 yrs.	268	,,	273 ,,

Herd-testing has been a very definite factor in the development of dairy farming in many areas in this State. The improvement at Myrtleford is best shown by a general survey of the movement.

The original unit has now grown to three, embracing 72 herds and 1,992 cows. This number includes 761 junior cows. In the herds under test, the number of pure-bred bulls is over 70 per cent.

The last average return for the three units was 255 lb. butter-fat per cow. Twenty of the herds produced better than 300 lb. of butter-fat, three of them being over 350 lb., two over 400 lb., and one over 500 lb. butter-fat per cow. Ninety-one cows produced over 400 lb. of butter-fat; seven of these yielded over 500 lb., and one over 600 lb.

These figures indicate the possibilities of dairy farming at Myrtleford, which is not by any means the best dairying land in north-eastern Victoria.

The Sheep Industry

(*continued from page 323*)

but during these few days the lambs go back in condition. When occurring after marking, the site of entry of the microbes causing the trouble undoubtedly is through the operation wounds.

Summary of Precautions.

1. Use fresh temporary yards each season if possible.
2. If permanent yards be used, clean them up before marking the lambs.
3. Keep the marking board clean.
4. Sterilize or disinfect hands and instruments constantly.
5. Drop the lambs on to clean pasture and finish early each day.

Some of the points that have been stressed may seem trivial, but it must be remembered that the saving of a small number of lambs each season will repay the breeder for the little extra trouble that may be taken before and during the process known as lamb-marking.

Seed Testing

By

J. E. Harrison, B.Agr.Sc.,
Senior Agrostologist.

The Plant Research Laboratory, Burnley, where seed-testing will be carried on.

THE practice of seed-testing was first established in 1869 by Dr. Nobbe, author of the first handbook of seed-testing*. Dr. Nobbe's work very soon attracted attention, and within a decade from the establishment of his station, seed-testing became an established practice in the agricultural countries of Europe. In 1880 there were approximately 30 such stations on the Continent, some of which rapidly grew to large institutions.

Seed-testing stations received the support of dealers and farmers alike, and the invention and development of seed-cleaning machinery followed as a matter of course. Such machinery has now attained a perfection which enables almost any impurity to be extracted by using an appropriate machine with an appropriate setting.

The early workers were concerned chiefly in defining the characters of small seeds and ensuring that they should be sold true to name and free from exceptional impurity. Not only did they find commercial samples of seeds to be mixtures of all sorts of cultivated and weed seeds, but actually they discovered also that several species were accepted in general trade, under entirely wrong names.

The operations of later-established stations have been directed largely to the maintenance of the conditions set up by the pioneers, and at the same time to perfecting the technique of testing. Apparently there had been considerable international trade in agricultural seeds prior to the introduction of seed-testing, and very soon the stations were working principally in the interests of the export and import trades. It is usual for a station to give a certificate of analysis upon testing a sample of seed, the certificate subsequently being used by the merchant in the sale of the seed. As different countries employed different methods in testing, it was possible to interpret a certificate only if the methods of testing were known, and as this was not always the case, much confusion existed in international trade. It thus came about that an International Seed Testing Congress was held in Germany in 1906, and in Denmark in 1910, the main object in each case being to obtain uniform rules of analysis for the various seed-testing stations. At a similar congress held in 1921, and attended by delegates from sixteen countries, a European Seed Testing Association was formed. In 1924, at a congress at which 26 countries were represented, this was re-constituted as the International Seed Testing Station. Yet another congress was held in Denmark in July of last year, when uniform rules for seed-testing and a common certificate for international use were adopted. The following is a copy of the certificate:—

* See the First Report of the Seed Testing and Plant Registration Station for Scotland.

INTERNATIONAL ANALYSIS CERTIFICATE

Issued by—

Name of Station:

Test No.: Sample received: Weight of sample:

Name of sender:

(Stated by Sender.)

Kind and variety of seed:

Country of origin:

Designation: (Latin name)

Seal:

(Analyst's Results.)

Kind: (ordinary and Latin name)

(stated by analyst)

Pure seed: (QM/SM) (cross out method not used)* .. .. %

Inert matter .. .. %

Other crop seeds .. .. %

Species

Weed seeds .. .. %

Species

100.0%

Total number of weed seeds per lb. *Dodder per lb. (only at request of sender)*

Germinating capacity (normal sprouts) in days† .. .. %

Hard seeds .. .. %

Worthless remainder (including abnormal sprouts) .. .. .. % %

100%

Pure germinating seed = $\frac{\quad}{100}$ = %

Content of moisture %

Place and date:

Signature .....

*QM means that the purity analysis has been made according to the quicker or Irish method for seed-testing; SM, that it has been made according to the stronger or Continental method.

†Under the germinated seeds of the legumes are included any healthy swollen seeds present upon the completion of the germination tests.

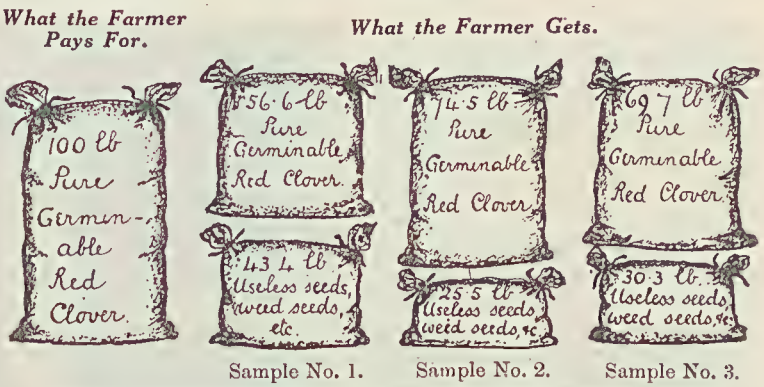
This certificate is issued with the understanding that the analyses and tests to which it refers are made in strict accordance with the International Rules for Seed Testing, and it is further agreed that if a lower result is later found and maintained the Station, whose stamp appears hereon, cannot be held liable for compensation.

The main difference in the methods employed in seed-testing lies in the recognition given to seeds which are immature, or consist only of empty glumes. The "continental" method of dealing with husks and immature seeds of the grasses is to regard them as impurities, and exclude them from the germination test. In the "Irish" or "quick" method on the other hand they are recognized as seeds, and included in the germination test if present in the sample. It will be apparent that the results obtained by the two methods will differ according to the proportion of husks and immature seed present. In the case of a thoroughly cleaned sample, containing no husks or immature seed, both methods will give the same result, but if husks and immature seeds are present, the "continental" method will give a higher germination and a lower purity result than the Irish or quick method. As the certificate approved of and adopted by the International Seed Testing Association allows the use of either method, and requires a statement only of the one employed, it is important for farmers and merchants alike to make themselves familiar with the differences mentioned above.

With increased emphasis being laid upon the desirability of high germination and purity in agricultural seeds, it is important for farmers and merchants to realize both the value and limitation of these characteristics. A perfect sample of seed would be 100 per cent. pure, 100 per cent. germinable, and true to name. By purity is meant freedom from weed seeds, other crop seeds, and inert matter such as chaff and dust and gravel, while a high germination percentage implies that practically all the seeds will germinate and form normal seedlings if placed under favorable conditions. Seed-testing is an analysis of purity and germination, and a means of comparing different samples of seed of the *same* variety or strain, but *not of different varieties or strains.* For example, it is usual for New Zealand South Island rye-grass to reach a high standard of purity and germination, but this does not make it comparable *as a type* with the certified perennial rye-grass of the same country, usually having a somewhat lower degree of excellence in these respects. It is possible, however, to compare one sample of certified perennial rye-grass seed with another by means of purity and germination tests. As a further illustration, over 40 distinct strains or types of subterranean clover have been isolated at the Burnley Gardens by the Agrostology Branch of the Victorian Department of Agriculture, but it is possible to identify only two of these definitely by examination of the seed—one white and one amber-seeded strain. It must be stated, however, that the efforts of investigators are continually being directed towards the discovery of methods of identifying seeds of different varieties and strains, but progress along these lines so far has not been very rapid, and for

the present it should be appreciated that seed-testing is a means of comparing different samples of seed of the one strain or variety only.

At the same time it must be understood that a high degree of purity and germination is important in seed samples of any particular strain. The presence of weed seeds, especially of noxious kinds, is always objectionable. Even small proportions by weight of weed seeds should not be ignored, because the actual number represented may be enormous. For example, a sowing of 20 lb. of perennial rye-grass seed containing 1 per cent. by weight of rib-grass would represent approximately 60,000 rib-grass seeds per acre, or about twelve seeds per square yard. Seed-testing reveals the presence (or absence) of these weed seeds, which have a great capacity for damage when sown broadcast over the farm in impure seeds.


What the Farmer Pays For.
What the Farmer Gets.
100 lb Pure Germinable Red Clover.
56·6 lb Pure Germinable Red Clover.
43·4 lb Useless seeds, weed seeds, etc.
74·5 lb Pure Germinable Red Clover.
25·5 lb Useless seeds, weed seeds, etc.
69·7 lb Pure Germinable Red Clover.
30·3 lb Useless seeds, weed seeds, etc.
Sample No. 1.
Sample No. 2.
Sample No. 3.

Figures showing the losses in purchasing the samples of seed referred to above.

The loss caused by the inclusion of useless seeds, weed seeds, and rubbish in the above samples on purchasing 100 lb. is shown graphically in the accompanying figure. Further heavy loss would be caused by the weed seeds after sowing.

A good sample of seed should fulfil several conditions. In the first place, it should be true to name, and of the correct species or variety or strain. It should be pure, or as free from impurities as modern knowledge and machinery can make it, and free also from injurious insects and fungi. It should be heavy, dry, fresh, and vigorous, with a high and rapid power of germination or growth. In clovers the percentage of "hard seeds" should be low. The country or locality in which the seed was grown should be known and specified, as often this information suggests the type or strain of a species, and throws light on the desirability or otherwise of sowing it down under Victorian conditions.

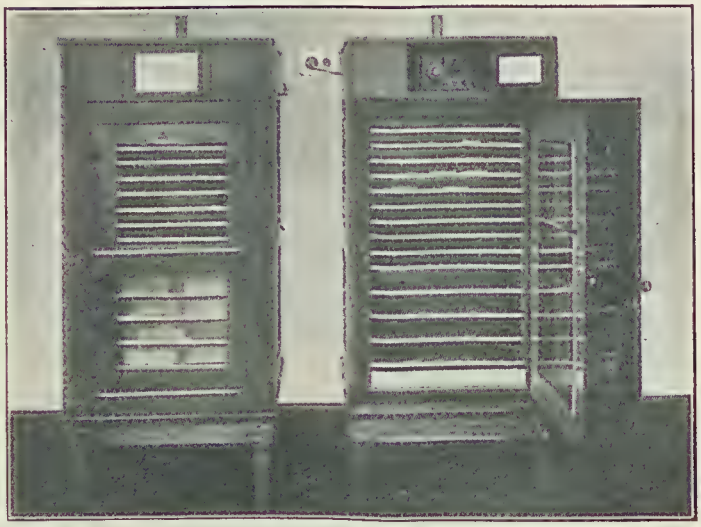
It is admittedly difficult to purchase seed with the assurance that it fulfils the above conditions, but it will pay the farmer to insist on those conditions as far as possible, and to take considerable pains in the selection and purchase of his seed. He should be prepared to pay a fair price for the seed he requires; if he insists on a low price, he is practically asking for low quality. It is not unusual at the present time for seed to be sold subject to a non-warranty clause, which may or may not afford legal protection, but it must be taken as an admission of lack of knowledge and confidence in respect of the nature and quality of the seed sold. The explanation probably lies in the fact that the great bulk of our small agricultural seeds is imported

Sample No.	Purity.	Germinating Capacity of Pure Seed.	Real Value.
	per cent.	per cent.	per cent.
1 ..	82	69	56·6
2 ..	92	81	74·5
3 ..	82	85	69·7

Note.—The real value of a sample consists of the proportion of pure seed which will germinate. It is arrived at by multiplying the percentage of pure seeds by the percentage of growing seeds and dividing by 100. Thus in sample No. 1 above, there was 82 per cent. of pure seeds. Only 69 per cent. of this pure seed germinated. The real value of the sample is therefore $\frac{69}{100} \times 82 = 56.6$ per cent.

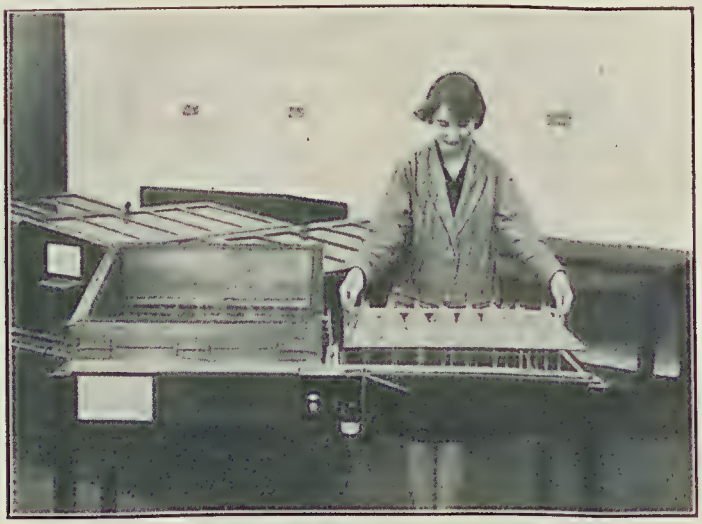
from abroad, giving every opportunity for the loss of identity in respect of type or strain, and subjecting the seed to transport conditions which, apparently, are not without an injurious effect upon its germinating capacity.

The remedy lies in our own hands, and if availed of, should remove one of the many disadvantages we suffer through failure to produce sufficient seed for our own requirements. The greater development of seed production in our own State should result in placing on the market more reliable seed as well as more seed of those species and strains most suited to our conditions and most likely to increase production. This is adequately illustrated in respect of subterranean clover and Wimmera rye-grass, two plants that have shown extraordinary adaptation to the soils and climate of southern Australia, and of which seed is harvested and distributed on a large scale to the general advantage of both grower and consumer. There is evidence of the same value of local strains of perennial rye-grass, cocksfoot, white clover, and other plants, but comparatively little seed of these is harvested, and dependence for our requirements is placed upon imports. The same position exists in respect of a score or more of small agricultural and horticultural seeds, which could well be produced by local growers. The situation is one which appears to contain opportunities for the individual, with prospects of benefit to the State.



Seed germinating incubator.

Seed production undoubtedly is work requiring skill and experience, in addition to some capital outlay, but the difficulties are not great, and once they are overcome the industry should benefit those engaged in it, and result in general advantage to the pastoral and farming community.



Improved tank germinator.

Auction Sale of Tobacco

An Analysis of the Results.

By W. J. B. McDonald, B.Agr.Sc., and G. E. Coghlan.

VICTORIA'S second tobacco leaf auction, conducted by Dalgety and Co., at Newmarket, on July 5th, when reviewed in the light of total sales effected, must be classed as a distinct success. Generally speaking, the quality of the leaf forwarded did not represent the best grade the vendors could have made available. Obviously this fact was fully appreciated by the buyers, and may have been responsible for their refusal to bid spiritedly when such lots were "under the hammer." Even so, had the total sales made been effected during the period of public auction, the large number of interested spectators and vendors would not have left the showroom doubting the efficacy of auction selling. A study of the appended sales analysis will indicate more clearly the actual result of the auction.

Although for many years established growers have queried the efficiency of the prevailing system of marketing their leaf, it was noticeable that few of the leading growers were prepared to support a departure from the existing method. From a publicity point of view alone this was unfortunate as the prestige of the North-East would have suffered considerably more than it did had it not been upheld by a new grower—Mr. Ford, of Gundowring—who exhibited the best prepared lot of leaf (not necessarily the best quality) in the sale, and was rewarded for his initiative by obtaining very excellent prices for the whole of it.

Though Pomonal leaf secured a good advertisement for itself by obtaining the majority of the highest prices offered, most lots from that

district contained a fair proportion of low-grade leaf.

Prices paid varied from 3s. 8d. to 3d. per lb. and were on the whole a fairly true reflex of the quality of the leaf offered.

Very few growers submitted a reasonable bulk of their top grades; seemingly they depended on their poorer and scrappy lines to afford them an indication of the possibilities of auction selling. Good quality leaf, moderately well got up, commanded high prices, while ill-graded, scrappy and immature lines were largely disregarded by buyers.

With this year's increased production it is anticipated that growers will not be able to make their top lines carry their poorer grades as in the past. When the supply of any commodity approximately equals the demand, each grade is sold on its own merits, and that condition is rapidly approaching, if it has not already arrived, in respect to tobacco sales.

From a technical aspect, the chief faults apparent can be grouped under three headings, viz.:—

(1) Baling methods.
(2) Grading.
(3) "Get up" of the lots.

Over 500 lots were offered for sale and almost every lot exhibited some individuality in the style of bale adopted. Hessian packs, sacks, and wool-packs, fastened in every conceivable fashion, made an unattractive and motley whole. The Department of Agriculture recommends a bale 3 feet x 2 feet x 2 feet, weighing from 180 lb. to 200 lb., wrapped with 14-ounce hessian and bound with three strands of rope. In actually packing the leaf in the bale some growers adopted the method of crossing each alternate row, whereas the recognized method consists of placing all the tips of the leaves toward the centre, leaving no butts facing the sides of the bale.

In baling leaf it is important to correlate the amount of pressure applied and the moisture content of the leaf. Leaf baled in too moist a condition bruises easily and consequently will not withstand high pressures without deteriorating; this was evident at the sale. A moisture content of 12 per cent. to 14 per cent. allows safe baling.

Where insufficient pressure had been applied, the bales had lost shape and the leaf in these instances suffered unnecessary damage in transit.

With one or two notable exceptions, grading throughout the sale left much to be desired. Invariably colour grades were badly mixed, in many cases dark and bright leaf occurring in the same parcel. Naturally the buyer assesses the bale on the value of the poorer fractions. Another obvious fault was the amount of damaged leaf found in an otherwise sound sample. Damaged leaf has not the same manufacturing value as sound, and should therefore be placed in a separate grade and parcel. Particularly does this apply to crops carrying a fair proportion of ragged leaf.

It was very obvious at the sale that size, especially in the darker lines, was an important factor in commanding a price, and where a crop contains much short small leaf this should never be handled along with big leaf of the same colour grade.

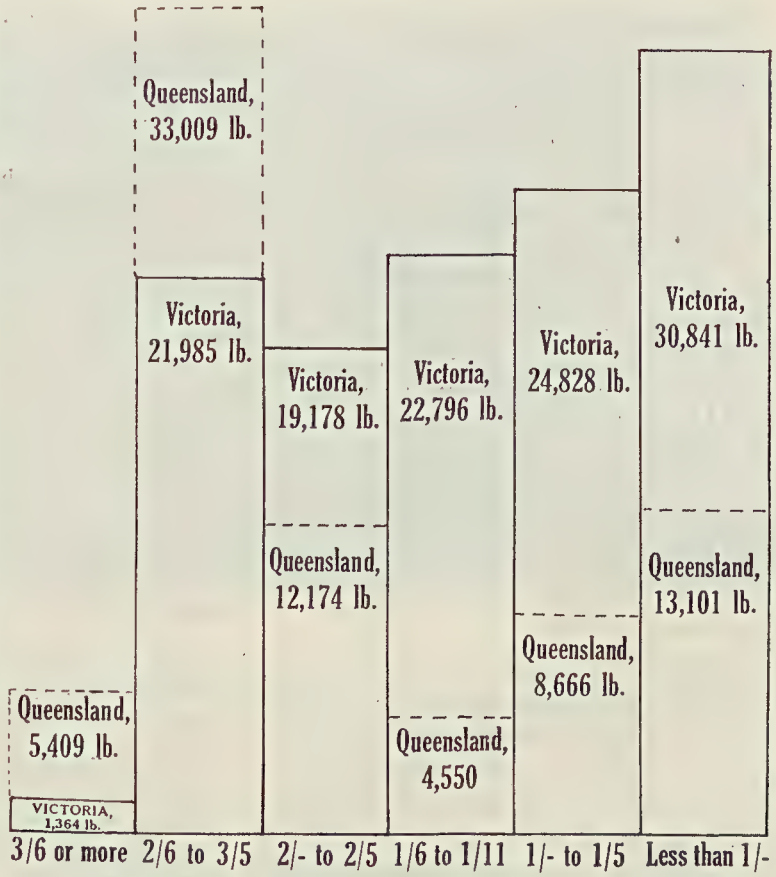
The term "get up" denotes the general appearance of the bale on its being opened. Here the majority of lots failed badly. The wrapping of the hands often was unsightly; this was mainly due to wrapping having been commenced too far from the butts and to the failure to keep sufficient tension on the wrapper leaf. In other cases, the wrapper leaf was not long enough to hold the butts together securely, while in still others the wrap was carried too far down the hand, thus detracting from the apparent length of the handed leaf. Tying the hand with inferior-grade or green leaf is the most objectionable practice of all, and unfortunately was very prevalent at the sale. The wrapper leaf forms quite an appreciable percentage of the total weight of leaf bought, and should be usable by the manufacturer for the same purpose as that for which the rest of the hand is designed. If the first impression created by a pack is a favorable one, the seller has taken a very pronounced step towards effecting a satisfactory sale.

A big bulk of green leaf exhibited on the floor should never have been offered. If the greenness is not too pronounced, this leaf should be bulked down and allowed to age when it will reach maturity in the bulk, and command a good price the following year.

Leaf that has been dried absolutely green, however, without attaining any semblance of a true colour remains useless for smoking purposes always, but might be saleable to a firm manufacturing nicotine sprays or dusts.

It will be seen from the foregoing that by failing to put up their best lines in the most attractive fashion the sellers refrained from assisting the auctioneer as much as they could have done.

In presenting the following figures it is pointed out that in a few of the 508 lots submitted the weights were not catalogued prior to the sale. In computing results these lots have been disregarded. During the actual period of auction on 5th July, 188 lots, totalling 64,959 lb. were sold; 98 lots, totalling 43,321 lb. were passed in; and 202 lots, totalling 63,890 lb. did not secure a bid. Up to the evening of the 7th July, however, a total of 120,992 lb. of leaf had been sold by Dalgety's, representing 71 per cent. of the total offered; and an increase of 56,033 lb. over the amount sold on the 5th. It is expected that the quantity sold will reach 80 per cent. of the total offered, and, considering the amount of poor leaf offered and the ridiculous reserves placed on other lots, this is a very satisfactory result. The average price over all sales effected up to the evening of the 7th July was 19.262d. per lb., and the average obtained for 18,818 lb. of Pomonal leaf sold (some lots from Pomonal, of which the ownership is not definitely known to the writers, are not included in this figure) was 24.92d. per lb.



Graph illustrating the volume of tobacco leaf sold at indicated price ranges at auction at Melbourne and Brisbane. The Melbourne sales are indicated by the continuous lines and the Brisbane sales by dotted lines.

One of the most provocative features of the sale was the activity that took place on the two days following the auction when 190 lots, totalling as before stated 56,033 lb., were disposed of.

Of these 190 lots, 69 were bid for at auction and passed in, while 121 had not commanded any bid, although in the majority of instances the auctioneer attempted to start the lot at a price below that for which it was eventually sold.

Of the 69 lots which were passed in at auction, 25 eventually sold at a figure equal to the final auction bid, indicating that the vendors' reserve was too high, while 44 lots brought prices well in excess of the final bid at auction. In 20 cases out of the 44 the final purchase price ranged from 10 per cent. to 75 per cent. above the final bid at auction; in 24 instances the increased bid was less than 10 per cent. greater than the final bid at auction. Of the 121 lots which were finally sold but for which no bid was made at auction, the price in 56 instances exceeded the valuation, in 27 it equalled the valuation, and in 48 it was slightly less than the valuation, the important point being that in approximately 83 cases at least the auctioneer did not receive

(*Continued on page* 347)

Tomato Culture

Raising Healthy Seedlings

By A. G. Strickland, M.Agr.Sc., Horticultural Research Officer

FOR the sake of economy of seed, earliness, and convenience in growing the crop, tomato plants usually are raised in beds of some kind, from which they are transplanted to the field in spring. The raising of the seedlings is a very important operation and more than half the battle against disease and unfavorable conditions is won, if well grown, healthy seedlings are available for planting out. Weak seedlings, which have suffered from ill-treatment in the seed beds, will not grow into good plants.

Most growers realize that serious diseases may occur in the seed bed, but it is not so well known that some diseases may be contracted in the bed and not become noticeable until later on in the field. In other words, a "dirty" seed bed may be the means of spreading the germs of disease to fields, which, previously were free from disease.

The object of this article is to outline briefly the methods of raising seedlings, and to stress those phases of the operation which are most important for the production of first-class plants.

The first essential is a supply of good seed. This requirement is best met by saving only seed from healthy plants, which produce a large crop of good type fruit. Indiscriminate gathering of seed from plants of all kinds will result inevitably in a proportion of seed which will produce plants with low cropping power, or bad type fruit. Let me then emphasize the need for careful selection of seed—selection for type as well as yield. Seed from a plant carrying a small crop usually will give poor yielding plants, and seed from a plant bearing fruit which is bad in shape or quality may be expected to give plants producing badly shaped or poor quality fruits. If seed has not been selected personally, the grower should procure his supplies from a reliable source. One ounce of clean tomato seed will produce approximately 2,000 tomato plants.

Methods of Raising Plants.

The most general method of raising young plants is in a seed frame. Fresh stable manure is packed tightly at the bottom of the frame, and covered with a layer of good sandy soil. The frame is covered with glass, and the decomposition of the stable manure produces heat, which may be regulated by raising or lowering the glassed cover of the seed frame.

The tray method is a definite improvement on this. With this system the seeds are planted in shallow trays 21″ by 15″ by 3½″, each of which will hold about 60 seedlings planted 2 inches apart. These trays may be constructed from old kerosene cases, and are of such a size that they may be carried in the field when setting out plants.

If a heated glass-house be available, these trays are laid out in the house. Where, however, a grower has to rely on stable manure for his heating, there is no reason why the trays should not replace the layer of soil usually over-lying the stable manure in the ordinary type of seed frame. The tray method has many advantages, not the least of which is the adaptability of the method to soil sterilization, to which reference will be made later. Certainly, the tray method entails more labour in planting seeds, but there is no doubt that it reduces the labour involved in setting out.

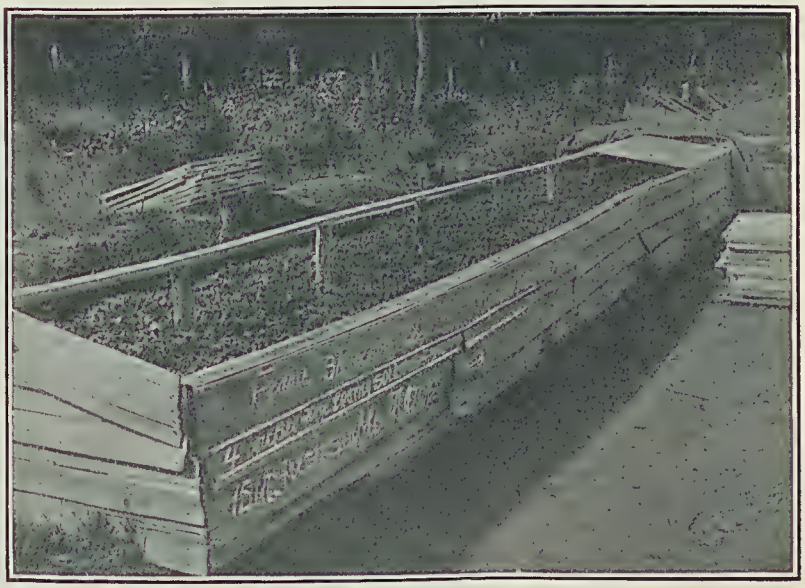
Some nurserymen and growers raise their seedlings each in a separate small pot, but it seems that this method has very little advantage over the tray method.

The Preparation of Soil.

Soil preparation for seed beds should be commenced long before seed beds are to be made. A good sandy soil should be mixed with manure and the mixture allowed to rot down for nine to twelve months before it will be required. At sowing time, this soil should be sieved, a little superphosphate added, and

spread out on the bed, or placed into trays. In the case of trays the bottoms may be covered with newspaper, or short straw, in order to prevent leakage of the soil through the cracks.

New soil should be made for seed beds or trays every season, as the use of the same soil year after year is liable to cause a concentration of diseases. That this is a real danger is evidenced by the fact that many growers have been troubled with increasing incidence of damping-off of seedlings every year. Unless a change of soil is made, or, if this is impossible, the old soil sterilized, any disease which may be present in the soil may be expected to become progressively worse from season to season. It is not only seed-bed diseases which concentrate in this manner. Whilst in the seed bed plants may be infected with diseases which will become evident, not during the seedling stage, but later in the field, and diseases of this nature may be spread from the seed bed to healthy fields. Once fields have become infected with germs of disease, it is almost impossible to get rid of them and for this reason, if for no other, every care should be taken to have clean soil in which to raise seedlings.



Hot-bed, showing glass and calico covering.

Soil sterilization may be resorted to when it is impossible to obtain new soil. The best method of sterilization is by means of steam. In some nurseries it is now a routine practice to steam sterilize all soil that is to be used for raising seedlings, and nurserymen who are using the method have been successful in reducing losses from damping off disease to a negligible percentage. The soil may be steamed in brick and reinforced concrete vats, fitted with a tight cover, and having perforated steam pipes, running under a false bottom. Steam enters the vat of soil at from 80 to 100 lb. pressure, the treatment being maintained for a period of 30 to 60 minutes. This system entails a fairly expensive equipment, which would be out of the question for any but nurserymen who are raising large numbers of seedlings. After sterilization, the soil is removed, allowed to dry, and filled into trays.

Seed beds may be sterilized by the inverted pan method where a supply of steam is available. After the area to be sterilized has been prepared for seeding, a galvanized pan 6 feet by 10 feet by 6 inches deep is inverted over the bed. The pan is pressed down an inch or so into the soil, and steam is run into it by means of a pipe entering the top of the pan. The steam will penetrate into the soil, according to its texture, penetrating more readily in the case of loose sandy soils than with heavy soils.

A method of soil sterilization which is more feasible for the average tomato grower is by the use of formalin, but where clean soil, free from disease, can be obtained, growers will prefer using new soil to carrying out sterilization. The formalin is used at the rate of 1 gallon of commercial formalin in 49 gallons of water. The soil in the seed beds, previously prepared for sowing, is soaked with this solution at the rate of two to four quarts per square foot. The bed is then covered with bags for two or three days in order to retain the active formalin gas in the soil. After removal of the bags, the soil should be loosened

and aired for at least one week before planting. It is advisable to wash down all woodwork in the seed bed with the formalin solution whilst it is available. This method is very useful where a grower wishes to replant a bed, which has suffered with damping off disease during the early part of the plant-raising season. Thorough airing of the bed after treatment is essential, as formalin is a very powerful disinfectant, and if present when the seed is planted may prevent its germination.

Cold Frame, showing glass, calico covering and tomato plants in tins.

The question of clean seed beds has been stressed because it is of very great importance; if new soil is not procured annually, some provision for soil sterilization is essential.

Sowing the Seed.

Two methods of sowing the seed are in general use. In most cases the seed is sown fairly thinly, and the seedlings which come up promiscuously are thinned out so as to have even spacing of two to three inches between seedlings in the bed. An alternative method is to sow the seed thickly in trays, or portion of the seed bed, and to prick out into new trays or another part of the seed bed, when the third leaf of the seedlings is about half an inch long.

After sowing, the seed is covered with a thin layer of the soil used in preparing the bed and the surface is sprinkled lightly with water. The glass is then placed on the seed frame and not removed until the seeds have germinated. After germination, the glass is removed gradually on sunny days in order to provide for ventilation, and to prevent the plants from growing too spindly. The best temperature for the growth of seedlings is between 60° and 70° F., and the raising and lowering of the glass covers should aim at maintaining a fairly even temperature within this range.

When the plants have reached the third leaf stage, that is, in about three weeks time, they are either pricked out into a further supply of trays or where beds are being used, they are pricked out singly, with a little earth attached to the root of each plant, and placed into a hardening off frame which has no bottom heat. The soil for a hardening off or cold frame is prepared in the same way as that for the hot-bed, the only difference being the absence of the fresh manure at the bottom.

When the young seedlings are pricked out into trays or a cold frame, they are planted about three inches apart, and for this purpose it is advisable to have a press board, studded on the underside with projecting pegs, each about three-quarters of an inch in diameter. After preparing the soil in the cold frame or trays, this press board is pressed down on the soil surface, and a number of equally spaced holes made in the soil, ready to receive the pricked out plants. During this process, the young plants should be handled by the leaves, not by the stems, and any weakly or diseased plants discarded. A single plant is dropped in each hole made by the press-board. Better root systems will be developed by the plants if they are planted out fairly deeply—almost to the depth of the two seedling leaves.

These pricked out plants, two to three weeks old, should be watered lightly after replanting, and shaded for two or three days by means of hessian covers over the glass of the cold

frame. After striking root, they should be watered and ventilated, by raising the glass covers for a few hours on sunny days. This period of ventilation should be gradually lengthened until the covers are taken off for the whole day. After about ten days of this treatment, the plants should become tough and hardened, and ready for planting in the field. During this period the plants should be given only sufficient water to prevent them wilting. Healthy seedlings at this stage should have a good spread of leaves, and strong thick stems slightly bluish at the base, but green at the top. If the stems or leaves are very purple, it may indicate that conditions are too cold or that disease is present. Sometimes the plants develop a purplish appearance owing to lack of phosphoric acid in the soil, and this may be remedied by mixing in superphosphate when preparing the seed-bed soil. It is a practice with some growers to pinch out the terminal bud of each plant a week or so before removing to the field. This prevents the plants from becoming spindly, makes a bushy plant, and is considered to increase the yield of early fruit.

Seedling plants in trays after planting.

Seedlings, showing effect of damping off fungus.

Particular care should be taken in watering the plant beds. Over-watering results in weak, sappy, spindly plants that are hard to transplant to the field, and recover slowly even if they survive transplanting. Excessive moisture, especially if given late in the day, encourages "damping-off," a disease which will be described later. Waterings should be given usually several days apart, and not until the plants are almost at wilting point.

There is evidence to show that where plants are to be set in the field late in the season, "hardening off" is not so necessary, and in fact, tender plants set at a time when they can survive, will prove more profitable than hardened plants. Hardening is necessary for early plantings, but for later plantings the writer would advise growers to be less rigorous in the "hardening" of seedlings.

Diseases.

Certain diseases may occur in the hot bed or in the cold frame, and it is advisable that growers should be able to recognize the more common diseases, and take suitable measures against them. If new soil has been used for beds, or if soil and frames have been thoroughly sterilized, there should be little danger of disease. Care should be taken, however, not to introduce disease into clean beds from an outside source by means of water, dirty utensils or tools. Seedlings should be inspected periodically, and any diseased or backward ones removed immediately.

The most serious disease in seed beds is "damping off."

(*Continued on page* 364)

Winter Irrigation of Vineyards

By F. de Castella, Viticulturist

Winter irrigation of vines and olives, Sagunto (Spain). (In some regions water is available only in Winter; the rainfall, however, is higher than on the Lower Murray.)

OF the several waterings given to our irrigated vineyards, that applied in the winter is the most vital; a fact that does not always receive the recognition it deserves. The value of winter irrigation is the more curious since this is a time of the year when water is not needed by the plant, which is in a very sound sleep and quite indifferent to soil moisture.

It is not until the spring awakening of the vine that soil moisture matters. At this time an adequate, though certainly not an excessive moisture content becomes very necessary, and this can best be assured by irrigating before the end of winter. There are several reasons why water is needed at this stage. In the first place, it ensures a good bud burst. If soil and subsoil are too dry at this period, many buds fail to sprout and much potential grape crop does not materialize. This is particularly so with the Sultana, a vine that is somewhat chary as regards its "show" of fruit in spring.

There are other reasons why winter irrigation is so particularly desirable, which are not so obvious and need explanation.

Irrigation has wrought a wonderful transformation in parts of Northern Victoria. It has made possible the growth of dried grapes and other products to the value of several millions sterling where, previously, there was only a rabbit-infested wilderness. In the application of water to these vineyards a high measure of proficiency has been achieved, and the methods taught by years of experience work to the general satisfaction of growers. And yet we are told by competent critics that our irrigation practice is not always perfect; mistakes are sometimes made, both in the timing of waterings and the quantity of water applied, the correction of which would mean better returns and reduced costs.

Too much water is often applied. For some years there has been a marked tendency among those who obtain the best results from their vines to use less and less water, but to put more and more work into the tillage of the ground. In the recent bulletin on "Community Irrigation," issued by the Council of Scientific and Industrial Research, Mr. A. V. Lyon makes the statement that "It is indisputable that the present methods entail application of irrigation water in unnecessarily large quantities." Opinions may differ as to how this can best be remedied. Personally, I consider that it is by curtailing, if not withholding altogether, the application of water in October and early November, and this cannot be done with safety unless ample moisture reserves have been established by winter irrigation.

Moderate soil moisture content in October and November presents several important advantages. It is in accord with the normal or natural growth cycle of the vine; it permits blossoming to take place under the most favorable conditions; it lessens susceptibility to fungous diseases; it steadies growth, and thus probably favours the differentiation of fruit buds for the next following season; and lastly, it reduces liability to sun scald, from heat waves in January and February.

Let us consider first, the normal growth cycle. When dependent on natural rainfall the vine sprouts in September, and soon enters on its period of most rapid growth, which continues, at an increasing pace, until a few weeks after blossom (November). In December, growth rate steadies; at first gradually, but soon in more marked manner, almost ceasing shortly before the fruit changes colour. The vine then appears to languish somewhat, though it recovers as the fruit ripens. This midsummer rest is quite normal, and indeed desirable; it corresponds with the formation of the seed, and usually occurs during hot weather and in the absence of rain. In European vine districts, where unseasonable rains prevent this check, and cause growth to continue, it is thought wise to induce it artificially by summer pruning.

Irrigating vines at Merbein (Victoria) in January. Such Summer waterings are a necessary complement of Winter irrigation in dry climates.

In our irrigated vineyards anything approaching this midsummer rest is the exception rather than the rule; frequent waterings too often result in continuous, unnecessary, and probably undesirable growth. Too many growers apply water whenever it is available—they seem to think the more vigorously their vines grow the better, and to look on this exuberant vegetation as proof that all is going well. It is the October irrigation that is most undesirable; it unduly stimulates growth at its period of maximum activity, resulting in a superabundance of "top hamper." After all, we grow vines to get fruit, and not leaves and canes in needless profusion—ample foliage is, of course, essential. There must be enough not only to ripen the grapes, but to store the reserves for the start of the following season. Vegetative growth greatly in excess of these requirements is unnecessary and wasteful. It is foliage that is most exacting as regards plant food, especially nitrogen. Excessive top hamper often competes with the fruit, part of the sap elaborated for it, by the adult leaves, wasting itself so to speak in needless development of young leaves and shoots, and dissipating much plant food to no useful purpose.

The vine blossoms in November. Though perhaps less harmful than rain or cold spells, watering during or shortly before this vital process no doubt acts in somewhat similar manner, and is therefore unwise. We top and cincture vines to weaken them, thereby improving setting; irrigation that unduly promotes growth at this time cannot therefore be desirable.

The withholding of irrigation in spring is a potent aid to disease control in a season of fungous visitation.

The midsummer rest also benefits the next season's crop, over 12 months ahead. We know that the rudiments or primordia of the future bunches are formed about this time, within the dormant buds. It has been found that fruit bud differentiation in apple trees is favoured by early cessation of growth; no doubt something similar applies to the vine. At any rate, those vine-growers who by lavish manuring and watering force exuberant growth, find it necessary to summer-prune in order to get fruitful pruning wood. They thus force their vines to take an artificial midsummer rest.

Lastly, the vine that is not unduly forced in November is much less liable to sun scald in January and February. This last is often the indirect result of excessive growth in early summer. The exuberant top hamper transpires enormous quantities of water and makes excessive demands on soil moisture. Such a vine is very much more exacting as regards irrigation when the fruit is about to ripen; its demands, in a heat wave, may be greater than can be met and severe sun scald may result. It is a general rule that the more water the vine gets in October-November the more it will want in January-February.

The winter watering may be given at any period of winter. For cultural reasons August is the best month. It is then possible to dispense with the watering should heavy rains fall

during the winter. But this rarely happens; though the surface foot be well wetted the subsoil at 4 or 5 feet may be almost dry. The soil auger is the best guide. Unless wetted to field capacity, to a depth of some 6 feet, the August irrigation should proceed. Needless to say the water table must not be unduly raised. Though tolerating a water-logged subsoil when dormant, the vine-roots must have air as well as water to function properly, from the first awakening of active life in spring. Postponement until September is injudicious for reasons relating to the control of Black Spot. It is also rather late to promote the bud burst. Some may doubt the wisdom of making the vine depend on the August watering for so long a period. In the majority of cases, it is the soundest practice. According to Mr. Lyon, " the majority of sandy and loamy soils retain sufficient moisture to enable them to carry over when planted with vines from August until late November." There are, of course, exceptions depending on soil and season. A heat wave may compel a watering before December. The vine must not be allowed to approach the wilting point. I have known shot-sized berries to drop from this cause, though, as usual, thrips was blamed.

The exigencies of community irrigation must also be borne in mind. Water must be taken when available, and this may not be exactly when it is wanted. Many an unnecessary watering is given owing to fears that the vines may not hold out until the next irrigation.

It is dangerous to generalize, and allowance must be made for all these factors. In the main, however, the best irrigation programme for vines is a copious winter irrigation in August, the second watering being delayed until late November, or even December if possible; subsequent waterings must be given as needed by the vine. January and February waterings are usually needed in dry climates; these cannot be fully dealt with in the present article which is mainly concerned with winter irrigation.

Some years ago Mr. F. L. McDougall, C.M.G., strongly advocated winter irrigation for vines on the lower Murray. European dried-fruit countries, he said, have a winter rainfall and only a small summer precipitation. On the Murray these conditions are largely reversed. Our present irrigation system keeps roots dry in July and early August, and pours in water during the stage of active vegetative growth. He recommended a winter irrigation, and the retention of moisture by thorough tillage, the second irrigation to be delayed until after the setting of the fruit, with subsequent irrigations as needed. The gain would be a maximum development of bunches, better setting, easier disease control, and a higher yield of better fruit.

The foregoing applies to regions where the vine cannot be grown without irrigation. In districts with almost sufficient rainfall, one irrigation only, applied in winter, can increase the yield very materially. A convincing proof was afforded some years ago by an old vineyard, near Sunbury, the wine yield of which had fallen to about 70 gallons per acre. Winter irrigation was provided, and though not supplemented by any later watering, it sufficed to raise the yield to 400 gallons per acre.

In conclusion, I would once more urge the value of the August watering, which not only ensures a good bud burst, but permits the elimination of the undesirable October irrigation, thereby improving the blossom, facilitating disease control, and making the vine much less exacting for water when the grapes are about to ripen.

Some Insect Pests of Stone Fruits

Control Measures Recommended

By Keighley M. Ward, B.Agr.Sc., Assistant Entomologist.

THE insects which attack stone fruits may be considered to comprise two main groups, (1) those which are present in the orchard in harmful numbers every year, and against which control measures must always be adopted, e.g., the Peach Moth, and (2) those pests which appear in plague numbers only at intervals of several years. It is among these latter that some of the most serious stone fruit pests occur. This group no doubt is affected to a greater degree than the first by variations in climatic conditions, and further fluctuations in the prevalence of certain of these pests probably is influenced by the activity of parasites and predators.

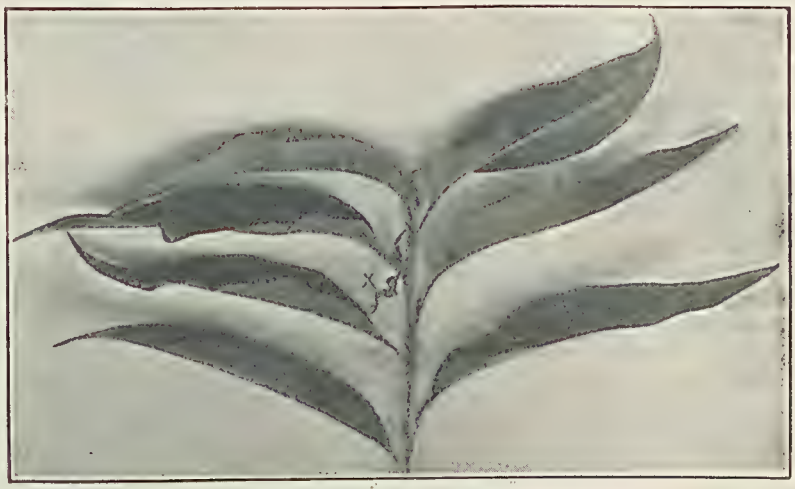


Fig. 1.—Typical twig injury, due to Oriental Peach Moth.

Included in the first group are the Oriental Peach Moth, the Pear and Cherry Slug, and the Black Peach Aphis; and in the second the Green Peach Aphis, and the Rutherglen Bug.

Oriental Peach Moth

(*Cydia molesta* Busck.)

The Oriental Peach Moth over-winters under the loose bark of fruit trees, among debris on the ground and in empty cases used in the transport of peaches. In the Goulburn Valley the first brood of the moth emerges during September and October, and the moths deposit eggs chiefly on the underside of peach leaves near the terminal ends of growing twigs. On hatching, the young larva eats its way into the succulent twigs, the first few mouthfuls of tissue being set on one side unconsumed. The larva then feeds by boring down the shoots often for several inches, with the result that the tip of the shoot wilts and dies.

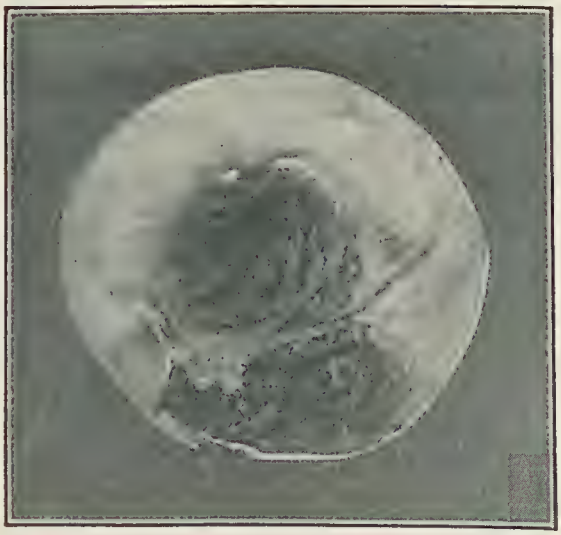


Fig. 2.—Fruit injury, due to Oriental Peach Moth.

The spring and early summer broods are thus passed through in the growing shoots. Fruit may be attacked while still only ½ inch to 1 inch in diameter, but the majority of it is attacked when nearing maturity. Most commonly the fruit is entered from the side, and the entrance hole is visible, but the larva also enters the fruit through the stalk, in which case there is no visible entrance hole. Pupation takes place in crevices on the tree, on the fruit and among rubbish on the ground. There are three or four broods of the moth between August and April.

In past years in the Goulburn Valley individual peach crops have been reduced by 30 per cent. by this moth. It is the late ripening peaches which usually show the heaviest infestation. Last season (1931-32) the average infestation in late peaches in the Goulburn Valley was approximately 6.7 per cent., the highest figure (10.9 per cent.) being obtained in the Ardmona district. With regard to twig injury (Fig. 1), it is the younger trees (two to four years old) which are most subject to attack, the effect being to stunt growth seriously if the twigs are severely injured for four or five successive years.

Control Measures.

The Oriental Peach Moth has been a serious pest of peaches for many years in the United States of America, Canada, and France, but so far, in spite of strenuous efforts, no satisfactory artificial means of control have been discovered.

In Victoria we rely on the activity of parasites and on supplementary control measures eventually to bring this pest under control. A number of hymenopterous parasites have been discovered in the Goulburn Valley—some attacking the larval stage of the moth and others the pupal stage. It is probably due to these parasites, and indirectly to the abnormally wet winter of 1931, that the Peach Moth infestation of fruit was so much reduced in the season just past

The following supplementary control measures are recommended:—(1) The cutting off of infested twigs during spring and early summer, and destroying them by burning; (2) the destruction of odd quince trees near peach blocks, as they are the favorite food of the moth, and provide excellent hibernating quarters.

The Pear and Cherry Slug

(*Eriocampa limacina* De Geer.)

The Pear and Cherry Slug belongs to the Sawfly group of wasps (*Tenthredinidae*), which are phytophagous or plant feeding in habit. The adult wasp, which is about one-quarter to one-third of an inch long, deposits eggs in slits, cut by the saw-like ovipositor of the female, usually on the underside of the leaf. The egg hatches in a few days, and the larva feeds on the upper epidermis of the leaf. The larva is at first pale, but after a few days it becomes covered with a slimy, dark-green secretion. When full grown, the larvae crawl down the tree trunk to pupate in the soil. They over-winter in the larval stage in the soil, the adult emerging the following summer.

The "slugs" or larvae first appear on the leaves in December and January, and they feed continuously until April. Trees heavily attacked by this pest would be forced to throw out new leaves during the heat of the summer, thus tapping the accumulated nourishment required for the development of fruit and leaf buds in the following spring. Cherry, plum, pear, and hawthorn trees are attacked.

Control.

This pest is readily controlled by means of lead arsenate applied as a dust or as a spray (1 lb. in 30 gallons of water).

Black Peach Aphis

(*Anuraphis persicae-niger* Smith).

The Black Peach Aphis lives throughout the year on the roots of the peach. In mild winter weather and in spring individuals migrate upwards and start colonies on the twigs and young shoots, usually those nearest the ground. Colonies may remain on the twigs throughout a mild winter, but it is more usual for the twigs to be reinfested each year from the roots. The hot summer months are invariably passed on the roots. In spring large numbers of winged forms appear among those on the twigs, and eventually all the forms above ground become winged. These migrate to other peach trees to found new colonies, and possibly to secondary host plants.

Control.

In planting young peach trees be sure the roots are free from these aphides. If they are present the trees should be dipped in a

Fig. 3—Black Peach Aphis.

1.—Insects on stem and young leaves (natural size); 2.—Winged female (magnified); 3.—Wingless female (magnified); 4.—Pupa (magnified); 5.—Winged male (magnified); 6.—Winged female (magnified).

solution consisting of ½ pint of nicotine sulphate, 2 lb. of soap (or 3 pints of emulsified oil) in 40 gallons of water. Twig infesting forms should be sprayed with a spray of 1 pint of nicotine sulphate, and 1 gallon of white oil to 80 gallons water. The winter sprays recommended for the Green Peach Aphis will also destroy any black aphis present at the time of spraying.

Green Peach Aphis

(*Myzus persicae* Sulz.)

The Green Peach Aphis first appears on the peach tree early in spring, and under suitable weather conditions it breeds prolifically. The young aphides hatch from over-wintering eggs on the peach tree during August and September, usually just before the buds burst. The young at first feed on the buds and blossoms, and later on the young leaves, causing them to curl. Several generations of the insect succeed each other until, during November, a generation of winged forms arise (spring migrants). They migrate to secondary host plants, where they feed throughout the summer months, their food plants being various weeds (marshmallow, cape weed, sow thistle), and garden plants (dahlias, peas, tomato, spinach, &c.). On these plants winged forms again develop during April and May (autumn migrants), and they fly back to the peach, where they give birth to the wingless egg-laying females. The latter are reddish brown in colour, and they deposit eggs around the peach buds during April, May, and early June.

There is a mild infestation of these oviparous or egg-laying forms in peach-growing districts of the Goulburn Valley and of the southern part of the State at the time of writing (May), and should weather conditions prove favorable next August and September, there is the possibility of an aphis outbreak. The mildness of the autumn weather has provided very suitable conditions for the breeding in numbers of the oviparous forms of the Green Peach Aphis.

The most serious damage is caused during spring, when the fruit and leaf buds are opening. In a plague year the aphids swarm over the blossoms and young leaves, extracting the sap, and thus interfering with the development of fruit and twigs. The leaves become curled and distorted, rendering control by

means of sprays almost impossible. Under the worst conditions of an outbreak yields of peaches are seriously reduced and the upper portions of many trees are killed. The upsetting of the normal functions of the leaves and the consequent stunting of growth is an effect which will influence the yield of fruit over more than one season.

Control Measures.

1. The application of an ovicide during the late dormant period (late July) will prove the most effective method of control of the Green Peach Aphis. The sprays recommended for this purpose are (*a*), lime-sulphur, 1 in 9 (this is also a control measure for brown rot of peaches); (*b*) red oil, 1 in 20; or tar distillate, 1 in 30. Peach trees should be carefully examined during the winter to determine whether the black-shining aphis eggs are around the buds.

2. If the winter spray is not applied the trees should be very carefully examined just as the buds are bursting, and if the small green aphis is present the following spray should be applied at once:—One pint of nicotine sulphate and 1 gallon of white oil to 80 gallons of water.

3. All prunings should be burned to destroy any eggs on them.

Several species of minute Hymenopterous parasites attack the Green Peach Aphis, in addition to the various predators—lady birds, hover flies, and lacewings. No doubt the large number of natural enemies of this aphis is a factor associated with the spasmodic outbreaks of the pest.

Rutherglen Bug

(*Nysius vinitor* Bergroth.)

The Rutherglen Bug is one of the worst of the native insects of Australia. It appears in vast numbers at intervals of several years, and its appearance usually is associated with a dry season. It is almost indiscriminate in its choice of food plants, which range from any succulent crop of vegetables or weeds to practically all fruit, especially the stone fruits

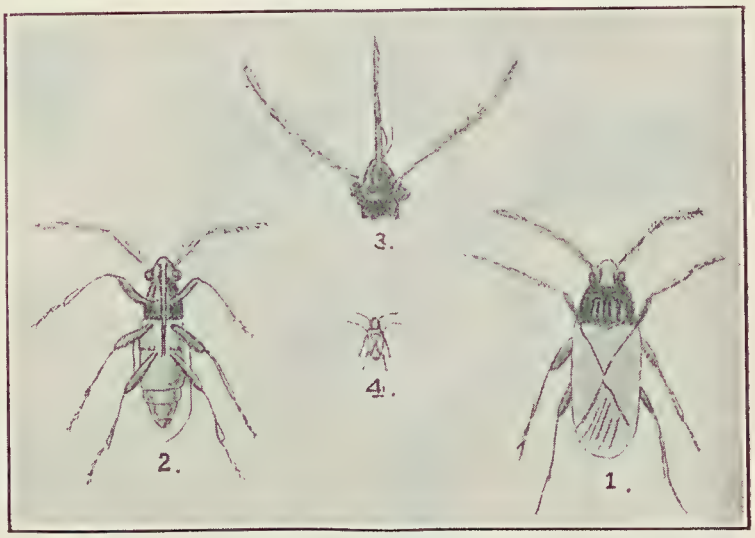


Fig. 4.—The Rutherglen Bug.

1.—Perfect insect, under view (magnified); 2.—Upper view; 3.—Head of adult insect; 4.—Adult insect, slightly magnified.

ripening in December and January. Peaches and apricots may be attacked while still green.

The principal breeding grounds of these insects are grasses, certain weeds, and some cultivated crops. Eggs are deposited in clusters on these plants, and they hatch in six to ten days. There is another period of about 24 days before the adult stage is reached. Each female is able to deposit up to 400 eggs over a period of three weeks.

Control Measures.

The following measures are suggested for orchards:—

1. Plough in or cut and burn grass and weeds on headlands in early spring, and keep this growth down during the first half of summer. This removes breeding grounds and food plants.

2. After spraying infested trees with the following spray, dust the trunk and main branches with lime to prevent bugs from ascending the tree—Phenyle, 1 quart; washing soda, 3 lb.; soap, 2 lb.; and water, 40 gallons. Shred the soap, and dissolve in boiling water before adding the other constituents.

3. Trapping.—Large numbers of bugs will congregate under heaps of rubbish placed about the orchard, and can be

destroyed by spraying with a strong contact insecticide early in the morning before they become lively.

4. Smudge fires on which a little sulphur has been sprinkled will drive the bugs away, but will not destroy them.

PREPARATION OF TOBACCO WASH.

For those growers who have a supply of tobacco waste at hand, the following information is given on a method of making a nicotine spray. The proportions of the materials required to destroy sucking insects are as follow:—

Tobacco waste	1 lb.
Soap	½ lb.
Water ..	6 gallons

Steep the tobacco in 1 gallon of hot water, and allow to soak for at least 24 hours. Then strain off the solution, pressing the liquid from the tobacco waste. Dissolve the soap in boiling water, and add it to the nicotine solution. Mix thoroughly and make up to 6 gallons.

Auction Sale of Tobacco

(Continued from page 335.)

a bid, although he endeavoured to start the lot at a figure below that which the buyers were prepared to pay for it. In one extreme instance a lot of 330 lb. which the auctioneer failed to start at about 1s. 3d. eventually brought 2s. 4d. per lb.

It was the failure of these parcels to obtain a bid at auction that created the greatest concern among the growers present, and although subsequent buying activities have done much to relieve this anxiety, it is probable that the buyers missed a valuable opportunity of establishing a complete confidence in their first valuation.

Where his crop is displayed on the floor along with numerous others, the grower has a chance of assessing its real market value and of obtaining an equitable price for it. Very little criticism can be levelled at the buyers for the prices actually paid at auction.

Whatever the reason for the first day's apathy, it must be recognized that the bulk of the leaf submitted has been sold at prices which are a fair index of its quality. An excellent feature of the sale was the interest displayed by the large number of growers present (the attendance was estimated at 1,000) and their very evident desire to discover for themselves the points in which their own lots failed. The sale was a very liberal education to all interested in tobacco growing.

DETAILS OF TOBACCO AUCTION.

	3s. 6d. and over.	2s. 6d. to 3s. 5d.	2s. to 2s. 5d.	1s. 6d. to 1s. 11d.	1s. to 1s. 5d.	Less than 1s.
	lb.	lb.	lb.	lb.	lb.	lb.
Leaf sold by auction on 5th July, 1932, at Melbourne	781	12,985	14,329	12,909	18,174	5,781
Leaf passed in at auction on 5th July, 1932, at Melbourne	..	6,608	6,355	13,682	14,676	2,000
Leaf sold subsequent to auction at Melbourne	583	9,000	4,849	9,887	6,654	25,060
Leaf sold by auction at Brisbane in June ..	5,409	33,009	12,174	4,550	8,666	13,101

The amount of tobacco unsold at Brisbane was 8,459 lb.

The amount of tobacco unsold at Melbourne on the evening of 7th July was 51,168 lb.

The total amount of leaf offered at Brisbane was 85,368 lb.

The total amount of leaf offered at Melbourne was 172,160 lb.

The value of the leaf sold in Brisbane was £8,267 5s. 3d.

The value of the leaf sold in Melbourne was in excess of £9,710 13s. 1d.

Orchard and Flower Garden

By Edward E. Pescott, F.L.S.

The Flower Garden.

DURING this and next month, such winter and early spring-flowering shrubs as Camellia, Azalea, and Rhododendron will be in flower. These are rather delicate plants, and do not give successful growth in hot climates or in open sunny situations; they should be so planted that they will not receive any sun during the afternoon. Further, they are surface-rooting shrubs; therefore cultivation should never be carried on close to them; in fact they need no cultivation, an annual top-dressing of leaves, leaf-mould, cow or sheep manure is all that they require, and any weeds should be removed by hand. As they love an acid soil they should never have lime; a dressing of charcoal dust is much relished by them instead. With ample water in summer, these plants give excellent flowering results.

Roses will soon be showing bud growth; therefore the plants must be watched for aphis, which should be sprayed with nicotine sulphate. In order to help growth, a small supply of ammonium sulphate should be worked in around the plants just when they are coming into growth.

As the young shoots increase in length, a lookout should be kept for mildew, which appears as a grey powder on the new growth. This must be dusted with sulphur, preferably in the early morning when the plants are wet with dew. Growing rose bushes should have an abundant supply of water always available.

Gladiolus corms may now be planted. The soil should first be well worked and the corms placed about three inches deep in a sunny and open spot. The resulting plants will produce flowers at the end of the year.

Generally, if the garden has been cleared and dug over, there is little to be done, other than the work mentioned, but with the advent of the first warm weather all spring seeds may be sown.

The Vegetable Garden.

Asparagus and rhubarb crowns should now be planted. Both require a very rich soil; in fact it can hardly be too rich, provided that it is drainable. Where there are old plants some of the surface soil may be removed, and replaced with a rich supply of manure.

Double Azalea.

In late districts, onion seed may be sown in rows; it is essential that the soil be good and deeply worked.

Broad beans and green peas also may be sown now. The old variety Windsor is the best of the beans, and either Greenfeast or Yorkshire Hero may be selected for the peas. It is advisable to dust the seed over with lime in the rows before covering with soil.

In the Orchard.

Preparation should be made for spraying for leaf-curl of peach and for brown rot of plums and cherries. Where these fungous pests have been known during the previous season, the trees must be sprayed with the lime sulphur spray to check their progress in the coming fruit season. Crops intended for green manure must not be left growing too long as they may interfere with the growth of the trees. As soon as the trees come into growth, the green cover crop should be under the soil.

Professional Papers

[This section is devoted to professional papers and articles of a scientific character.]

Studies of Growth and Fruit Bud Formation

No. I.—A Year's Observations on Victorian Apples (1) (2)

By C. Barnard, M.Sc., Botanist, Division of Plant Industry, C.S.I.R., and
Frank M. Read, M.Agr.Sc., Senior Horticultural Research Officer, Department of Agriculture, Victoria.

IT has long been known that blossom is formed in the buds of most fruit trees during the season prior to that in which those buds flower. Ball(2) quotes Dr. Beale, 1656(4), thus:—"Before December, by the bluntness of the bud, you may discover what branch will bear fruit the next season immediately following."

It must, too, have been realized by early horticulturists that the conditions obtaining during that season affected the ability of the tree to produce blossom buds, for certain practices, designed to increase blossom bud formation, are of comparatively early origin. We read(6) that Quintinye(31) in 1746 advocated the summer pruning of apples to this end; while Howe(18) refers to Prince(30) who in 1832 advocated ringing as a means of increasing the productiveness of woody plants. The fact, however, that these practices have never come into general use, and are to-day the subject of as much controversy as they probably were then indicates the scant progress which was made in this direction.

It was not until the close of the last century that horticulturists, realizing the probable importance of the time of application of measures designed to control fruit bud formation, set themselves the task of determining microscopically the time of the year at which this blossom forming process was initiated.

Lazenby(22) and Goff(14) were the pioneers in this work, particularly Goff, who in Wisconsin studied the development of the blossom buds in the apple, pear, plum, peach, and some of the bramble fruits. As a result of these investigations, it was found that during the early part of the growing season all the buds on a tree were similar in structure and development; and at this stage it was not possible to distinguish potential blossom buds from potential leaf buds. At a later date some of the buds were distinguishable by the nature of their development as blossom buds. The time when this occurred varied with the variety, and in certain cases with the type of fruiting wood on the same plant. Nevertheless in the yearly growth of each variety of fruit a short critical period was recognized during which the initiation or differentiation of the following season's blossom could be seen.

Later workers who have materially contributed to this subject include Drinkard(7) in Virginia, Bradford(6) in Oregon, Tufts and Morrow(40) in California, Ball(2), Gibbs and Swarbrick(13) in England, and Bijhouwer(5), Luyten and De Vries(24) (25) in Holland.

The information so obtained has been used by various workers in planning field trials of pruning, ringing, manuring, and other orchard operations; but the results have remained, until quite recently, as contradictory and confusing

(1) An article dealing with similar studies on the Sultana appeared in the *Journal of the Commonwealth Council for Scientific and Industrial Research*, Vol. 5, No. 10 (3).

(2) This work has been carried out by the Council for Scientific and Industrial Research, and the Department of Agriculture, Victoria, in co-operation. The selection of varieties, the sampling of material, and the observations on tree behaviour have been made by the Victorian Department; whilst the C.S.I.R. has carried out the microscopical examination of the buds, and the preparation of the photomicrographs.—[ED.]

(3) The numbers in brackets throughout the text refer to the works of reference cited at the conclusion of the paper.

as ever. For instance, Gardner(8) found that summer pruning of young apples in Oregon hastened the development of a fruit spur system; while Alderman and Auchter(1) in Virginia were unable to encourage early fruitfulness by this means. Similarly ringing, which has been found by Swarbrick(38) to encourage fruit bud formation, is not considered a satisfactory measure at the New York Experiment Station(18). Victorian experience has been that the results of these and other orchard practices vary widely from district to district, and give rise to endless controversy amongst growers.

The variable responses of trees to such treatments has been traced by Kraus and Kraybill(20), 1918, and many later workers to hitherto overlooked differences in the internal composition of the trees. In particular, attention has been directed to the carbohydrates and nitrogenous compounds in the tree; and it is now considered that the balance between these two components, or, as it is usually termed, the carbohydrate-nitrogen ratio, largely decides the type of vegetative growth made, and the degree of fruitfulness of the plant.

It is considered that when the carbohydrates are relatively very high, and the nitrogen low, the plant tends to be stunted and weakly in growth, and unfruitful. When the nitrogen is relatively very high and the carbohydrates low very strong vegetative growth is produced, but in this case also the tree is unfruitful.

The fruitful condition is associated with moderate growth and an intermediate ratio of carbohydrate to nitrogen. The actual quantities of these substances present are not so important in deciding growth type as the balance between them. It is not suggested that the carbohydrate-nitrogen ratio is the sole factor of this type. The balance between other elements in the plant probably will be found upon further investigation to be equally important.

Consideration of the carbohydrate-nitrogen ratio leads one to realize that the effects of such orchard practices as ringing, pruning (both dormant and summer), the application of nitrogenous fertilizers, and clean cultivation as compared with the growing of trees in sod may be expected to vary in accordance with the chemical composition of the trees subjected to such treatment. The chemical composition of the trees in any district will be determined largely by the climate and soil type met with.

Hooker(17) in a systematic chemical analysis of various types of fruiting and non-fruiting apple spurs found that "conditions leading to a high starch and low nitrogen content at the time of fruit bud differentiation appear to be essential for productivity." This general conclusion has been supported by many later workers, and most horticulturists hold the view that an accumulation of carbohydrates in the cells adjacent to a developing bud just prior to and during the time at which differentiation of fruit buds occurs is favorable to the differentiation of that bud into a fruit bud. In the absence of such an accumulation, the bud develops into a leaf bud. Potter and Phillips(29), on the contrary, state that they find the accumulation of insoluble nitrogen in the spurs to be favorable to fruit bud differentiation.

It is not likely that such comparatively inert substances as starch or insoluble nitrogen do, as such, affect growth or the initiation of blossoms, and it may be that the presence of enzymes necessary to unlock the energy which such stored materials represent is another essential factor in the process. To date this aspect has received little attention, although Heinicke(16) has suggested that high catalase activity is associated with a tendency to vegetative growth and decreased fruit bud formation; but Roberts(33) in a limited amount of work could not detect in his material any such correlation.

Garner and Allard(9) (10) (11) (12) have drawn attention to the importance of the length of daily illumination on the growth and fruiting responses of plants. They have shown that while some plants can produce flowers under both long day and short day conditions, or in other words can adapt themselves to wide variations in climate, other plants are much more specific in their requirements. Some are fruitful only where they receive a short daily period of illumination; others require a long day.

These observations were first explained in terms of the stimulating effect of light; but more recently they have been correlated with the carbohydrate-nitrogen theory. Nightingale(27) (28) in a chemical study of plants of each of the classes of Garner and Allard, subjected to various lengths of daily illumination, found that the effect of length of day

was primarily upon the extent of photosynthesis, and elaboration of nitrogenous compounds which could be effected during the given period of illumination. This largely decided the chemical composition of the plant. He further found that growth and fruiting responses could be correlated with chemical composition in the way that Kraus and Kraybill had postulated. Kraybill(21), by shading apple and peach trees, was able to produce somewhat similar results. In his case shading depressed the elaboration of carbohydrates, and greatly reduced fruit bud formation. Sudds(37), on the other hand, by reducing the length of day of strawberry plants to eight hours, hastened the initiation of blossom buds.

There is no doubt that one effect of pruning is its influence upon the illumination of the remainder of the tree. It is also reasonable to expect that weather conditions which affect the hours of sunshine materially influence fruit bud formation.

The relation between vegetative growth and fruitfulness postulated by Kraus and Kraybill(20), and supported, as indicated, by many subsequent experiments, has been corroborated by field measurements of the growth of apple trees. Roberts(33) (34) (35) has made extensive measurements of apple trees in Wisconsin; and has found that it is on shoots and spurs of intermediate length that the fruit buds of a tree are most readily formed. On chemical analysis such organs have disclosed, by comparison with those of greater and shorter growth, an intermediate carbohydrate-nitrogen ratio. He has also associated thickness of shoots with fruitfulness; and concludes that conditions favorable to an increase in diameter of the wood, due to the laying down of reserve materials, are favorable to blossom formation.

The apple root stock investigations at East Malling(15) are also of interest in this connexion. These stocks have been classified into four groups in accordance with their effect upon the growth of scions worked upon them, and named respectively — 1, very dwarfing; 2, semi-dwarfing; 3, vigorous; 4, very vigorous. A negative correlation between growth and fruitfulness has been established. The very dwarfing stocks encourage earliness of bearing; and the increase in vigour through the series is accompanied by a progressive decrease in blossom and fruit production. The class which has made the greatest growth has been, at all events in the early years, the least productive. Even the very dwarfed trees, of course, have not reached the weakly vegetative unfruitful condition. The type of growth produced on dwarfing stock in Victoria is quite healthy, though reduced in amount. The comparison above is, therefore, really between trees of moderate as against vigorously vegetative growth; and the negative correlation noted between growth and fruitfulness is in agreement with the work previously described.

There is, however, in these experiments a very interesting exception to this negative correlation. If the individuals of one variety on any single type of clonal stock be studied separately, a considerable variation in growth is noticeable amongst them; but in this case the trees which have made the greatest growth are the most fruitful. That is to say, if individuals having the same inherent characteristics are compared, a positive correlation between growth and fruitfulness is found. In this State, where the vegetatively raised Northern Spy stock is used for apples practically to the exclusion of all others, it may be quite unsafe, within fairly wide limits, to assume that vigorous growth and fruitfulness are incompatible.

The work of Swarbrick(39) indicates a possible explanation of this apparent contradiction, and gives us a dynamic conception of growth. He stresses the importance of the date at which elongation growth ceases rather than its total amount. At Long Ashton those apple stocks, which induce greater fruitfulness in a scion, apparently also induce an early cessation of length growth. In those trees in which growth continues later into the summer, fruit bud formation is markedly depressed. He points out that if growth ceases some time prior to the period of blossom initiation an accumulation of carbohydrates is made possible. Protracted growth, on the other hand, utilizes the carbohydrates and restricts the amount available for blossom initiation.

It is conceivable that, so long as growth ceases early enough, its vigour may well bear a positive correlation with fruitfulness; but that where greater growth is due to a more protracted growing period, and a later cessation, a negative correlation is to be expected. It is possible that in a group of trees of identical origin both of stock and scion the date of growth cessation from one member to another does not vary greatly even though the amounts of growth made prior to this date may have varied considerably.

Victorian Studies.

This dynamic conception of growth is considered to be of the utmost importance; and systematic measurements of a large number of Victorian fruit varieties, at short intervals throughout the year, have been undertaken in the hope that they will yield a clearer conception of the differences between trees in different districts, and of the behaviour of trees from year to year in relation to variable seasonal conditions.

The results of the first year's studies on apples are submitted in the following sections of this paper. The growth data are available for varieties from Templestowe, Victoria, only, and though of a preliminary nature are considered sufficiently interesting to warrant their publication at this stage.

It has been possible to determine the date of initiation of fruit buds in each of the varieties studied, and to trace their subsequent development in great detail. The results of these experiments are expected to be a valuable guide in the conduct of field investigations, particularly those relating to the problem of biennial bearing in apples (32). Furthermore, they are essential if an accurate application of the results of experiments in other countries is to be made under Victorian conditions.

Sources of Material.

At Templestowe, the Jonathan has been selected as a mid-season variety, blossoming with the main batch of Victorian apples. The Yates represents the class which matures its fruit very late, while the Rome Beauty is a typical late blooming sort. The three varieties are growing side by side on rather poor soil, and making but moderate growth. The trees are eighteen years old, and all on Northern Spy stocks.

At Harcourt, the two principal varieties, Dunn's and Cleopatra, have been selected. Trees of the former variety are twelve years old and fairly vigorous; those of the latter are more than twenty years old, and of rather poor growth. The Harcourt district is nearly 100 miles north of Templestowe, and has a much warmer summer climate.

Column 3, Table 1, shows the type of fruiting wood from which the buds of each variety have been cut, the numbers referring to the following classification:—

1. Terminal buds on the current season's shoots, and more occasionally axial buds.
2. Terminal buds on new spurs produced during the current season on two-year old wood.
3. Terminal buds on spurs two years or more in age.

TABLE I.—Showing Time at which the Majority of the Buds of the Different Varieties Reach the Stages Described in the Test.

Variety.	Locality.	Type of Bud.*	Stage 2.	Stage 3.	Stage 4.	Stage 5.	Stage 6.	Stage 7.	Stage 8.	Stage 9.
			Differentiation.	Axillary Primordia.	Sepals Terminal Flower.	Petals.	Stamens.	Carpels.	Winter Condition.	Development Recommencing.
Yates ..	Templestowe	2	12.12.30 to 19.12.30	End of Dec.	1st week in Jan.	Mid-Jan.	3rd week in Jan.	3rd week in Feb.	Beginning of May	Not reached by Mid-Aug.
Jonathan	,,	2	12.12.30 to 19.12.30	1st week in Jan.	3rd week in Jan.	End of Jan.	3rd week in Feb.	Mid-Mar.	End of May	Not reached by Mid-Aug.
Rome Beauty	,,	3	2.1.31 to 23.1.31	3rd week in Jan.	Mid-Feb.	Beginning of Mar.	Mid-Mar.	End of Mar.	Mid-Aug.	
Cleopatra	Harcourt	3	4.12.30 to 31.12.30	3rd and 4th week in Dec.	Mid-Jan.	End of Jan.	1st week in Feb.	Mid-Feb.	End of May	Mid-Aug.
Dunns ..	,,	3	31.12.30 to 15.1.31	2nd week in Jan.	End of Jan.	..	3rd week in Feb.	..	July	

* See "Sources of material" for description of the bud types.

In each case the particular type of bud predominating in the tree selected was chosen for examination. Although it is probable that the dates of fruit bud initiation in classes 2 and 3 are quite close, it has been found(6) (26) that those of class 1 usually are initiated considerably later.

Collection of Buds.

For each variety examined in detail, five trees were selected, and at each collection a composite sample of fifteen buds, three drawn from each tree, was made in duplicate. The second sample was not examined in every case, but only in those in which confirmation of the first appeared desirable.

Each bud was cut as close to its base as possible, so as to avoid any surplus material, and the outer bud scales were often removed when readily detachable. Immediately after cutting the buds were placed in a fixing solution of the following composition:—

60 per cent. alcohol, 96 ccs.
40 per cent. formalin, 4 ccs.

They remained in this solution until removed for examination. Samples were taken from trees once a week until after differentiation had been observed; and thereafter at intervals of three weeks.

Microscopical Examination of Buds.

Two methods were used in the microscopical examination of the buds. The first was by means of microtome-made sections of material embedded in paraffin. The outer scales of the bud were removed, and the air held between the inner scales and among the hairs exhausted by means of a strong vacuum pump in successive changes of 60 per cent., 75 per cent., 90 per cent., and absolute alcohol. For the most part the material cut easily at a thickness of 10μ. The buds collected late in the season occasioned a little difficulty, but it was found that by paring the paraffin block ready for the microtome, cutting close to the material and soaking for several days in water, ribbons could be obtained quite satisfactorily.

The second method was that which has been adopted at Wageningen(5) (24) (25). The buds were placed in 90 per cent. alcohol, and dissected under a binocular microscope at a magnification of from 50 to 100 diameters, by the aid of a suitably arranged illuminant. Excellent views are obtained in this way especially when the material is stained in a strong solution of iodine and potassium iodide. This method not only gave a more accurate conception of the structure of the buds especially during the early stages of differentiation[1], than the sections afforded, but also proved more rapid than the paraffin procedure. The adoption of this method for the bulk of the examinations permitted of the examination of 1,500 buds, thus giving an accurate estimate of the development. The later stages are, however, illustrated by means of photomicrographs of sections because of the greater difficulty in representing the dissections.

Bud Development.

a. Organization of the bud.

Except in certain details these studies have confirmed the very excellent description of the structure and development of the terminal mixed bud of the apple, given by Bijhouwer of Wageningen (1924) (5). Bijhouwer's work, however, is not well-known, and certainly has not attracted the attention it merits. On this account, and because of the inaccessibility of his publication to the majority of horticultural research workers in Australia, the salient features of the organization and development of the bud are set out in the following: —

The terminal spur bud, by the end of January, is composed usually of 21 leaf formations inserted in a close spiral sequence upon a short axis. The outer or basal eight to nine formations are scales, and are followed in sequence by two to three "transition" leaves, five to six foliage leaves, and three to four bracts. The outer scales are hard, membranous, dark-brown in colour and generally glabrous, whilst the inner ones are lighter in colour, very hairy and sometimes slightly trifid. The hairiness and size of the scales, as well as the closeness of their insertion on the axis, varies somewhat in different varieties.

The transition leaves are tripartite (lamina and stipules), and in this way differ from the scales; they are also densely hairy. The stipules are as long as or longer than the

(1) An example of the inadequacy of the microtome section method used alone is to be found in a paper by Gibbs and Swarbrick (13). In our opinion the drawings indicate that bracts have been confused with flower primordia in the younger stages; whilst in the representation of older buds, which possibly showed the development of flowers, a quite misleading conception of the structure has been obtained. The sections appear to be oblique and not in the median plane.

lamina, and this feature distinguishes them from the foliage leaves in which the stipules are much smaller. In the foliage leaves moreover the lamina is always glabrous. The bracts differ from the foliage leaves in that they possess no stipules.

The bud scales, transition leaves, and the first foliage leaf bear nothing in their axils, but in the axils of the second and third foliage leaves vegetative points, which later become axillary buds, are developed. In the axils of the fourth and fifth leaves, as well as in those of the first three bracts, flower primordia are formed (Fp., Fig. 3, Plate 1). Usually nothing is borne in the axil of the fourth bract. Two bractlets (S., Fig. 3, Plate 1), which are transversely placed accompany each axillary floret. Bijhouwer found that, in addition, a secondary axis with two bractlets either grown together or not, and sometimes also a small flower with its two bractlets occurred in the axils of the primary bractlets. We did not observe this feature in our studies of the apple, although it was noted quite frequently in the pear. The occurrence indicates a dichasial ramification of the inflorescence which is normally a corymbose raceme.

The axis terminates in a flower (Fig. 4, Plate 1) which bears no bractlets. When the bud opens in the following spring the bud scales and bracts usually drop, whilst the foliage leaves and transition leaves expand below the flower cluster, the transition leaves being composed of a very small lamina flanked by two comparatively large stipules.

b. Development of the bud.

Stage I.—During November and prior to the time of differentiation the growth of the bud consists of the splitting off of leaf-formations from the growing point, and no outward difference can be seen between the potential fruit bud and the potential leaf-bud. The axis of the bud is very short, and the growing point flat and inconspicuous (Fig. 1, Plate 2).

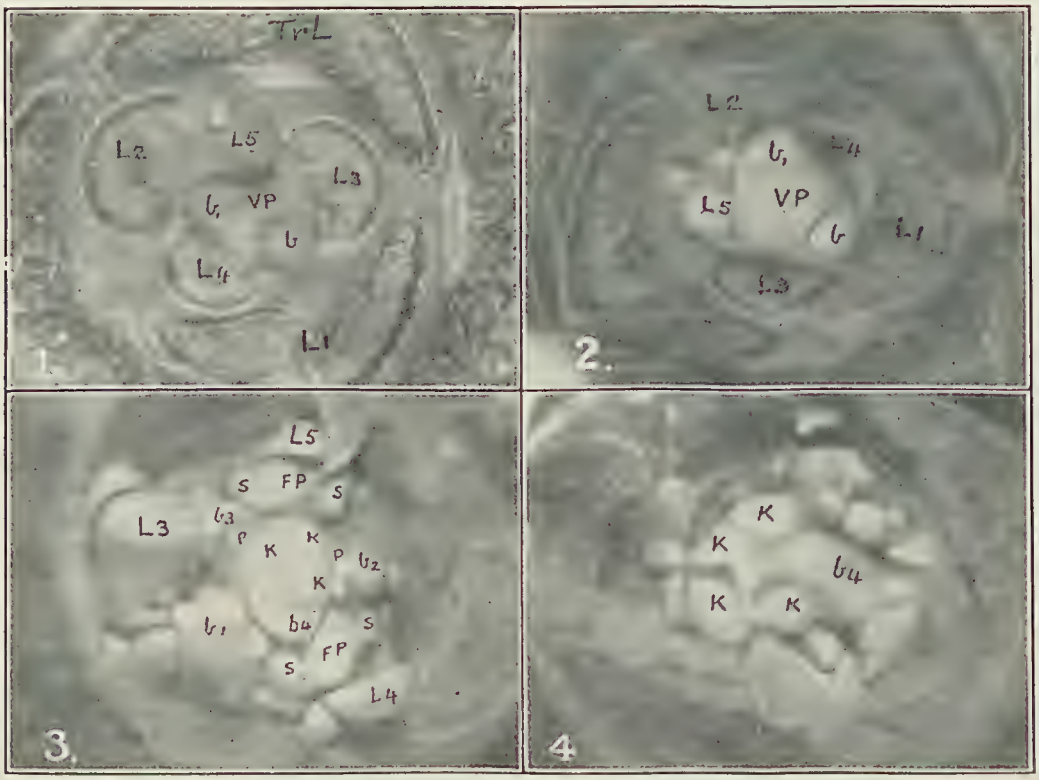


Plate 1.—Blossom bud development in the Cleopatra Apple, Harcourt, Victoria (magn. x 72). For explanation see text.

Key:—FP, Flower primordia; S, Bractlets; Cr, Crown; VP, Growing point; b, Bracts; Tr.L, Transition leaves; L, Leaves; K, Sepals (calyx); C, Petals (corolla); A, Stamens (androecium), and G, Carpel (gynaecium).

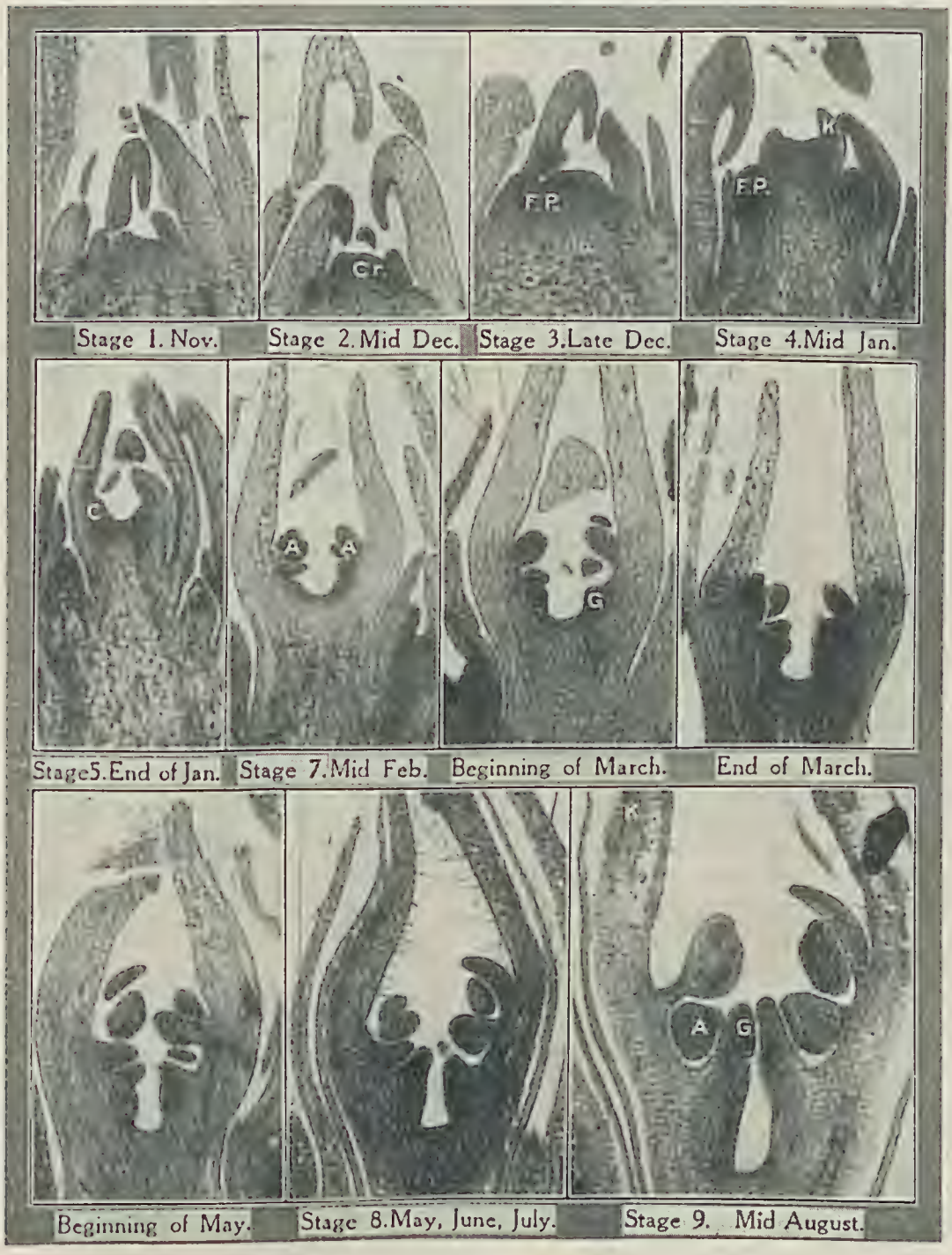


Plate 2.—Blossom bud development in the Cleopatra Apple, Harcourt, Victoria (magn. x 50). For key see Plate 1.

Stage II.—The first indication of differentiation is seen in a general enlargement—both elongation and broadening—of the axis in the region of the crown ("Cr," Fig. 2, Plate 2), which is accompanied by an enlargement and elevation of the growing point itself* ("V.P." Fig. 1, Plate 1). This occurs just about the time when the formation of the bracts commence (b and b1, Fig. 1, Plate 1).

The enlargement and elevation of the crown and growing point continue (Fig. 2, Plate 1, and Fig. 3, Plate 2), whilst the remainder of the bracts are split off, and the primordia of the first flowers appear in the axils of the upper foliage leaves.

Stage III.—The apex then flattens preparatory to the formation of the terminal flower, and the first axillary primordia differentiate into bractlets and flower primordia proper. This stage is represented in Fig. 3, Plate 1, where b1 to b4 indicate the bracts and L1 to L3 the upper foliage leaves. The primordia in the axils of bracts 2, 3 and 4 are shown at p whilst those in the axils of the foliage leaves have differentiated into flower primordia proper (Fp) and two bractlets (s).

Stage IV.—The formation of the sepals of the terminal flower then takes place; the axillary flower primordia flatten on top, and a ridge is formed from which the sepals develop later (Figs. 4, K, Plates 1 and 2).

Stage V.—Petal initials are formed in the terminal flower, whilst sepals differentiate in the lowest axillary ones (Fig. 5, Plate 2). The development of the axillary flowers follows that of the terminal flower, the lowest ones always being slightly in advance of those above. In the succeeding stages described, and in Table 1, only the development of the terminal flower is referred to, while in Plate 2 only the terminal flower is illustrated in the later figures.

Stage VI.—The stamen initials are formed in three whorls; the first consisting of ten and the inner two of five each. These are differentiated in rapid succession.

Stage VII.—The carpels next appear as five prominences from the base of the receptacle, and their development is illustrated in the series of photomicrographs in Figs. 6-11. The sepals have grown considerably when this stage is reached, and have become very hairy.

Stage VIII.—This stage (Fig. 10, Plate 2) is reached by the buds of most varieties about the end of May, and except for a very slight increase in the size of the parts of the flower, the winter is passed in this condition.

Stage IX.—Growth in the buds of most varieties had not recommenced by mid-August, when observations for the season 1930-31 ceased. The stage represented in Fig. 11, Plate 2, shows the recommencement at this time in one of the most advanced varieties. The parts of the flower increase rapidly in size, and the stamens which have slowly differentiated into anthers and filaments during the winter show definite sporogeneous tissue.

The times at which the buds of the different varieties passed through the stages of development described above and illustrated in Plates 1 and 2, are shown in Table 1. The dates shown in the column headed "Stage II., indicate for each variety the much discussed period of fruit bud initiation.

Growth of Trees.

Templestowe.

At each visit, after the sample of buds had been collected, measurements of tree growth were made. The objects of making such observations are twofold. In the first place it is desirable to correlate, if possible, the time of fruit bud differentiation with a definite stage of growth, so that horticulturitss may be able to determine it sufficiently accurately in the field, and without recourse to microscopical means except for certain exact investigational work. Secondly, systematic measurements of growth over a period of years will furnish a much needed basis for the discussion of tree performance in its relation to varying seasonal effects, and the incidence of pests or other variable factors.

Owing to lack of personnel, the measurements made this year have been rather scanty, and of a preliminary nature. They are possibly sufficient, if continued for some years, to enable the first objective to be reached; but in regard to the second objective they are not nearly sufficiently complete or precise; and cannot be interpreted quantitatively. Nevertheless they are briefly discussed from this point of view because of an important point which has emerged, and as an indication of the possibilities of studies of this type.

* Bijhouwer (1924) (5) describes the growing point during the period of leaf-formation as narrow and "pointed," and states that the first indication of flower-formation is found in the broadening and "flattening" of the apex. On the other hand, the description given by Luyten and De Vries (1926) (25) of the differentiation of the bud of the pear agrees very closely with our observations in respect to the apple.

On one tree of each variety a small number of shoots, growing from the terminal buds of the previous season's uncut laterals, and leading shoots, was labelled; and at each visit their lengths to the nearest millimetre and the number of their leaves were recorded. Leaf measurements to the nearest millimetre were also made, and the diameters of the current season's growth, and of the two-years-old wood at its base were measured. A number of spurs was also marked, and on each the number and sizes of the leaves of the terminal bud were determined. Further, notes were made in general terms of the growth and crop of the surrounding trees in the orchard. Table II. summarizes the information obtained.

The spur leaves of the Jonathon and Yates were those of new spurs on two-years-old wood —the type of spur bud collected; while in the Rome Beauty, as old spurs were sampled, the leaves of old spurs were measured. Leaves of old spurs on Jonathon and Yates, however, were found to synchronize in the time of their full development with those of the new spurs. Thus in the Rome Beauty late blooming has been followed this year by a relatively late cessation of growth of the spur leaves; and of the shoots as well. Thickening of the two-years-old wood at the base of the measured shoots in all varieties commenced practically as soon as shoot elongation ceased. It is, therefor, somewhat later in Rome Beauty than in Jonathon and Yates.

On the 24th of December, 1930, following heavy rains, nearly every growing point on the Jonathon and Rome Beauty trees was seen to have recommenced growth. This applied not only to laterals and leaders, but also to spurs which, in most cases, elongated appreciably and produced numerous new leaves. The Yates variety made no such second growth. Measurements the following week showed that the thickening of the two-years-old wood had ceased simultaneously in Rome Beauty and Jonathon, but was not interrupted in Yates. It was not until some time after this second growth had ceased that thickening of the older wood was resumed.

Figure I. illustrates this interesting association. The significance of these observations will be discussed later. The remaining details of Table II. are self-explanatory.

Harcourt.

General observations only were made in the Harcourt district. The two varieties bloomed together during the second week in October, The spur leaves of Cleopatra ceased growth during the first week in November; Dunns ceased two weeks later. Following the heavy rains in late November the majority of the spurs of Dunns began to grow about the beginning of December, sending out many new leaves, and in most cases an elongation growth of 2 to 3 inches. This second period of growth continued until late December.

The Cleopatra trees in this orchard were making very little growth, and for this reason probably did not exhibit a second growth in the spurs; but the phenomenon was evident in

TABLE II.—Showing the Progress of Growth of Apple Trees at Templestowe, Victoria, Season 1930–31.

—	Jonathan.	Yates.	Rome Beauty.
Full bloom	Oct. 10	Oct. 12	Oct. 28
Spur leaves fully grown	Nov. 6–14	Before Nov. 6	Dec. 5–12
Shoot elongation ceased	Nov. 21	Nov. 21	Dec. 1
Thickening of 2-year-old wood commences	Nov. 25	Nov. 25	Dec. 5
Terminal leaf of shoot fully grown	Dec. 12	Dec. 5–12	Dec. 5–12
Shoot elongation recommences	Dec. 24	*	Dec. 24
Thickening of 2-year wood ceases	Jan. 1	Feb. 20	Jan. 1
Shoot elongation ceases again	Feb. 1	..	Jan. 16
Thickening of 2-year wood recommences	Feb. 20	..	Feb. 20
Second period of thickening of 2-year wood ceases	Mar. 20	..	Mar. 20
Fruit mature	Mar. 7–14	April 23–30	Mar. 24–April 1
Defoliation commences	Mar. 30	Feb. 7†	May 1
„ 50 per cent.	May 22	Feb. 20	May 22
„ complete‡	June 30	May 30	June 30

* There was no secondary growth period in Yates.
† Very early defoliation—trees making unsatisfactory growth.
‡ In the case of Jonathan and Rome Beauty a few terminal leaves on the secondary growths persisted until early August.

adjacent orchards where Cleopatras were more vigorous.

Shoot growth of Cleopatra was very weak and complete early in November. In Dunns, shoot growth was vigorous, and continued until the end of December. A noticeable quickening of growth occurred early in December at the time of the second period of spur growth; and it is obvious that the November and December rains prolonged growth at Harcourt in a similar manner to that observed at Templestowe. The second stimulus appeared to be received about three weeks earlier at Harcourt.

Discussion of Results.

Relation of Growth to Time of Blossom Initiation.

There appears to be no correlation between the dates of fruit bud initiation and fruit maturity. Neither is there any concise relation between blooming date and blossom initiation; for, although Rome Beauty, a late bloomer, is correspondingly later in blossom initiation than Jonathon and Yates at Templestowe, there is just as great a difference in dates of initiation between Cleopatra and Dunns at Harcourt—two varieties which bloom together.

There appears to be some connexion between the date at which growth of spur leaves ceases and initiation.

Tables I. and II. studied together indicate a reasonably close connexion at Templestowe, and a similar relation holds for Cleopatra and Dunns at Harcourt.

A later cessation of spur leaf growth may be associated, as in the Rome Beauty, with late blooming; but at Harcourt the type of growth and general vigor of the tree seem to be the responsible agents. Fruit bud initiation appears this year to follow maturity of spur leaves after an interval of approximately five to six weeks. Cessation of shoot elongation and the commencement of thickening of the older wood would also appear to be useful from this point of view; but owing to their abnormal features this year further data are desirable.

In Yates the period during which blossom buds were initiated was much shorter than in the other varieties at Templestowe. The more extended period of initiation in the latter may be associated with the second period of shoot elongation.

The Failure of the 1931-32 Apple Crop in Victoria.

One of the most interesting features of this investigation arises from the fact that it covers the season immediately preceding the present one in which a severe decline in the Victorian apple crop has occurred.

TABLE III.—Showing Rainfall and Hours of Sunshine per month during Growing Season, 1930-31, at Templestowe, Victoria.* The records are also expressed as percentages of the average for a long period of years.

Season, 1930–31.	Rainfall.†		Bright Sunshine.‡	
	In Points.	As Percentage of Average for 61 Years.	In Hours.	As Percentage of Average for 50 Years.
		%		%
October	408	119	177	87
November	366	130	196	83
December	785	286	181	72
January	204	88	198	76
February	171	91	241	100
March	990	341	178	87
April	292	100	167	102
May	311	103	133	96
June	545	177	68	61
July	360	131	109	101
August	228	82	123	80
September	343	109	174	101

* Figures supplied by the Commonwealth Meteorological Bureau, Melbourne.
† For Warandyte, the nearest official recording station, distant 5 miles.
‡ For Melbourne, distant 11 miles.

The thrips invasion which coincided with the blooming period this year has been generally blamed for the poor fruit setting; and while it is in no way suggested that this view is incorrect, it is felt that contributing factors of quite a different nature have played a considerable part, and are deserving of more attention than they have received.

The 1930-31 growing season was abnormally wet. Table III. shows the rainfall figures for Templestowe, and indicates that the precipitation in December was nearly three times the average, and in fact a record for 61 years. This December rain undoubtedly was the cause of the second growth period recorded—a quite abnormal feature for Victorian apple trees. Although only the Templestowe figures are quoted, it is well known that similar conditions were State-wide, and, as has been seen, tree behaviour at Harcourt, a northern district, closely resembled that at Templestowe in the south.

The effect of this second and unusual growth, as shown in Figure 1, was to interrupt the normal accumulation in the older wood of reserve materials from which the following (i.e., the present) season's blossom was developed. In short, this prolonged growth took place at the expense of fruit bud formation. The result was a reduction of the number of blossoms initiated in some cases, and in most cases, probably, a reduction of the strength and ability to set fruit of those blossoms which formed. Roberts(33) (34) has shown that the ability to set is markedly affected by the type of growth made by the spur the previous year.

These conclusions are strongly supported, too, by the work of Lees (23), who has shown that, in England, high summer rainfall has a marked effect in prolonging length growth and depressing the following season's crop. Prolonged growth which is the result of root stock effect has been found by Swarbrick (39) to similarly reduce yield.

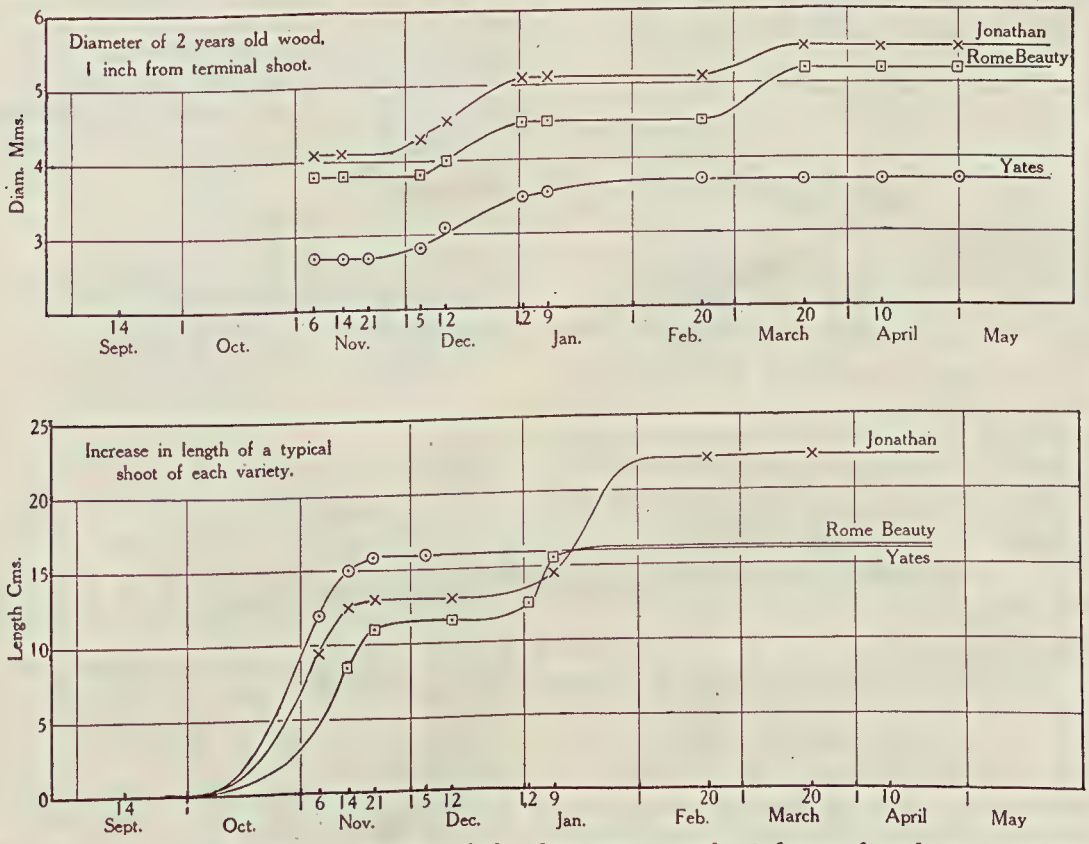


Fig. 1.—A graphical representation of the elongation growth of shoots of apple trees and its relation to the diameter increase of the two-years-old wood one inch below the base of the measured shoot—Templestowe, Victoria, 1930-31.

The cloudy weather as indicated by the "Bright Sunshine" figures in Table III., and the consequent low temperatures, may be expected to have had a cumulative effect in reducing carbon assimilation by the leaves (19). This would limit still further the amounts of reserve materials translocated to the older wood and the developing buds. The shading experiments of Kraybill(21) mentioned previously are of interest in this connexion.

Strickland(36) reports that the viability of the pollen of several varieties of apples, determined by germination tests on artificial media, was abnormally low this year. The results reported in this paper indicate a possible reason for the low viability he found, and strengthen the view that growing conditions in the season prior to blossoming have a material influence on the setting of the crop.

From a growth point of view season 1930-31 was of exceptional interest, and strikingly illustrates the value of routine growth measurements. It is intended that these shall be continued and extended to other Victorian districts as far as personnel will permit.

Summary.

1. In the introduction the problem of fruit bud formation in fruit trees is briefly discussed, and attention is drawn to some of the more important investigations pertaining to it. The scope of the present work is indicated.

2. The varieties of apples examined are Jonathon, Rome Beauty, and Yates at Templestowe, and Cleopatra and Dunns at Harcourt.

3. The methods used in the sampling of the buds are described. Two methods of bud examination were used—the cutting of microtome sections of material imbedded in paraffin, and the dissection of buds under a binocular microscope at a magnification of 50 to 100 diameters.

4. The initiation of blossom primordia and their subsequent development is described in great detail for each variety, and illustrated in Plates 1 and 2.

5. Detailed observations upon the growth of the trees at Templestowe are summarized in Table II. Less detailed measurements were made at Harcourt, and are discussed in general terms. The outstanding feature was a second elongation growth period in most of the varieties relatively late in the season, and during this period the normal thickening of the older wood of the tree was interrupted. These abnormal growth features are attributed to the unusually high summer rains.

6. No correlation was found between the dates of fruit bud initiation and fruit maturity, nor between initiation and blossoming. Initiation seems to occur five to six weeks after the spur leaves have reached full growth.

7. In those varieties where a second elongation growth was made blossoms were initiated over a fairly extended period, as compared with, say, Yates at Templestowe, when no late growth occurred.

8. The suggestion is made that the failure of the apple crop in Victoria to set satisfactorily in the spring of 1931 may be traced, to a great extent, to conditions of growth during the previous summer and autumn, i.e., the season under review.

Acknowledgments.

The writers wish to thank Messrs. F. Pritchard, of Harcourt, and C. Barnard, of Templestowe, who made available trees for observation; and Mr. Con Pritchard, who frequently assisted in the field work at Harcourt. The valuable assistance given in the field work at Templestowe by Mr. A. A. Hammond, Senior Orchard Supervisor, is especially appreciated.

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Endosperm Characters in Wheat

Owing to lack of space it has been found necessary to hold over Part III. of the article on Endosperm Characters in Wheat. It will be included in the *Journal* for August.

Rose Diseases and Their Control

(Continued from page 94.)

By B. J. Grieve, M.Sc. (National Society's Research Scholar; Fred Knight and Wyselaskie Scholar.

XIX.—DOWNY MILDEW OF ROSES.

DOWNY Mildew is a more insidious disease than Rose Mildew. Its presence may not be noticed on roses until the disease is well established, and, given humid weather conditions, it may then cause very extensive damage in greenhouses devoted to rose culture.

Eriksson[4] believes that practically all types of roses are susceptible under conditions favorable to the fungus. In Europe Downy Mildew has been observed on such roses as Baron Rothschild, Captain Christy, Fischer Holmes, Alfred Colomb, Duke of Connaught, Magna Charta, and General Jacqueminot. It has been found occurring on *R. californica,* and the variety Golden Emblem in the United States.

Names Applied.

Downy Mildew, Black Mildew, False Mildew.

History and Distribution.

Eriksson[4] states that the disease was introduced into Europe from India. It was first observed in 1862 in glasshouses in England, and the fungus causing it was described by Berkeley[1]. About fifteen years later (1876-1878) it caused great loss in Berlin glasshouses (Wittmach[8] 1877). In 1884 it appeared in Denmark, where over two thousand cultivated Tea roses were affected. Soon after it was reported from many parts of Denmark, and finally in the neighbourhood of Copenhagen. It continued to spead in the greenhouses there, over a period of three years. About the same time it appeared in the rose-growing areas of Rome.

In Silesia, the early varieties became diseased in 1891 and great destruction was wrought in seed-beds there. Over four hundred thousand (400,000) roses were killed out. The disease made its appearance in Holland in 1901. In Sweden it was first observed in a glasshouse near Stockholm in 1905. In 1910 the south of Sweden was swept by an epidemic of the disease which caused great havoc, one house containing over four hundred (400) standard roses being ruined. In 1912 the fungus appeared as epidemic in Middle Sweden, as a result of the importation of diseased roses from Germany.

Fig. 21.—Downey Mildew of Roses** (Peronospora sparsa) **after Eriksson.

The disease was prevalent in Austria in 1912, according to Brettschneider[2]; while Massee[7], in England, describes the damage done by Downy Mildew in glasshouses there in 1910. More recently (1924) an epidemic of the disease occurred near Dresden, in Germany. Halsted[5], in the United States of America, reported the appearance of Downy Mildew there in 1892. Brooks[3] records it as still being serious in England in 1928. The disease has not as yet been recorded in Australia.

Symptoms.

Young, vigorous leaves suddenly begin to droop, and fall at once if the shoot is slightly shaken.

The shoots also soon become limp and die back. Close examination of the plants show that affected leaves bear numerous scattered spots of irregular form. On the upper surface the spots are at first pale red to purple, later brown, and they bear on the lower surface a whitish-grey mould-like fungal patch. On the stalks, elongated dark brown, sunken spots appear. At the tip of the year's growth the leaves are unequally formed and more or less crinkled or rolled together, while the blossom buds show a stunting in growth.

Etiology.

Downy Mildew of roses is caused by the fungus *Peronospora sparsa* Berk.

Morphology.

Conidiophores scattered, about nine times branched, ultimate branchlets reflexed; conidia broadly elliptic, 17-22 x 14-17 μ pale grey in colour. Oospores brown, with a stratified wall 30-40 μ in diameter.

Life History.

The conidial stage was the only one known until 1913, when Lind[6] described the oospores belonging to the fungus. The conidia borne on the ramifying conidiophores germinate quickly in moist humid weather, and spread the disease in space. The fungus overwinters by means of the thick walled oospores which are found in the tissue of the leaf spots, in the bark of stems, and on fallen twigs.

Control.

The disease may be adequately controlled both in greenhouses and in the open by dusting plants with sulphur-lead dust, as for Rose Mildew, and by spraying with Bordeaux mixture. Plants in greenhouses should be given plenty of air, and all fallen leaves and twigs should be swept up and burnt.

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XX.—GREY MOULD OR BLOSSOM BLIGHT OF ROSES.

Comparative studies are wanting to show whether this disease is very serious. It is not generally regarded as being important, but it is possible that when further work has been done many of the so-called "die-back" conditions in roses may be traced to attacks of this fungus. It has been found attacking H.T's, H.P's, and variety Radiance. It is reputed to be common on certain white-flowered varieties.

Botrytis cinerea Pers., the causative fungus, has a wide host and geographical range; it has been found parasitic on the rose in England[4], and on the Continent of Europe; in the United States of America[2], and in Australia (New South Wales 1915).

Symptoms.

According to Waterman[3], the fungus seems to affect only the undeveloped buds or half-opened blossoms. Noticeable features in this disease are the drooping of the buds and their failure to open, while the flower stems may be killed back to a distance of several inches.

Waterman[3] states that in some cases infection of the blossoms by the fungus causing Brown Canker (*Diaporthe umbrina* Jenk.) precedes the appearance of this Blossom Blight.

Etiology.

Blossom Blight, or Grey Mould, of roses is caused by *Botrytis cinerea* Pers.

Morphology.

Conidiophores erect, unbranched or seldom branched, septate, 11-23 μ thick. Conidia ovoid or elliptical to almost globose, finely apiculate at the base, 9-12 x 6.5-10 μ with almost hyaline, slightly brownish wall.

Control.

Infected blossoms and stalks should be cut back. Plants should be sprayed with ammoniacal copper carbonate (copper

carbonate ¼ ounce, strong ammonia water 4 tablespoonfuls, water 2 gallons).

Berger[1] recommends that rose bushes be sprayed in the winter with 5 per cent. bisulphite of lime. This should be followed in the summer by a treatment with a dust consisting of 10 kilograms (3 pounds) of bisulphite of lime, and 90 kilograms (27 pounds) of clay.

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Tomato Culture

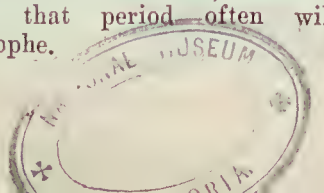
(*Continued from page* 339.)

Plants are attacked at soil level, the stem tissue becoming soft brown and constricted, and as a result the plant topples over. This is a common trouble in hot beds and cold frames. The disease spreads from seedling to seedling on the moist soil, and for this reason thick sowing should be avoided, as it helps to maintain a moist surface. Relatively warm temperatures favour the disease, and therefore late seedlings are more liable to damp-off than earlier ones. Various fungi are associated with damping-off, and these can be carried over from season to season in the soil, and on frames or trays. To avoid damping-off then—use new soil for seed beds, or sterilize by one of the methods described above. Do not overwater or over-crowd seedlings, and keep the beds cool and well ventilated. An outbreak of the disease often may be checked by watering with a solution of Cheshunt Compound, a disinfectant which will kill the damping-off fungus, but which is harmless to plants. This mixture is prepared by mixing finely powdered copper sulphate and ammonium carbonate in the proportion of 2 oz. of the former to 11 oz. of the latter. The dry mixture is stored in a stoppered glass or stone jar for at least 24 hours before using and is then prepared for use by dissolving 1 oz. of the mixture in 2 gallons of water. Cheshunt Compound may be purchased already mixed from most seedsmen. Metal vessels must not be used as containers for the solution.

Seedlings occasionally contract a root-rot due to "Black-Dot Disease," which may kill them in the bed. Frequently, however, such plants survive, are planted out in the field, and brown off and die after setting their first crop of fruit. When pricking out or transplanting, discard any plants which have poor root systems and particularly those with brown, constricted, roots with a decayed appearance.

When seedlings are stunted and blue and the roots are rotten, brown and dying back from the tips, this indicates a root rot of some description, and such plants should be removed and destroyed. Never, under any consideration, transplant such plants if they are detected during pricking out.

Close attention to these points will assist the production of strong healthy seedlings, which will form the foundation of a good even stand of plants in the field. One of the most critical periods during the life of a tomato plant is while it is in the seed bed, and keen observation during that period often will avert a catastrophe.



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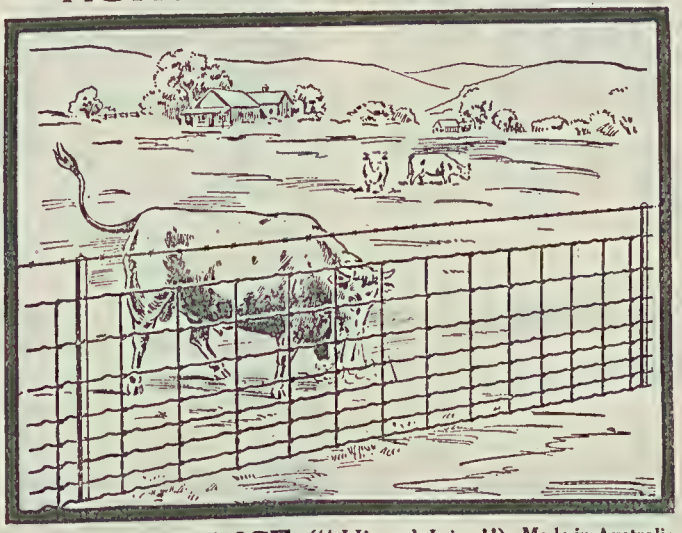

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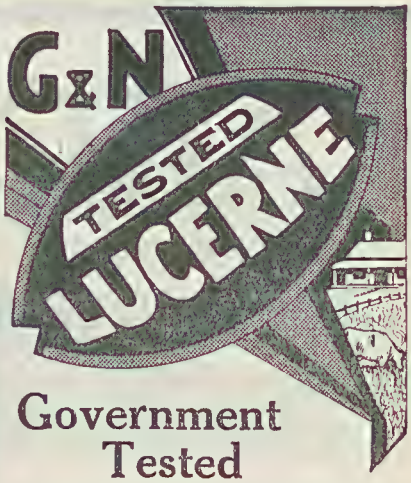

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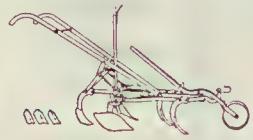

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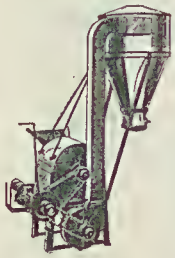

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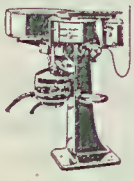

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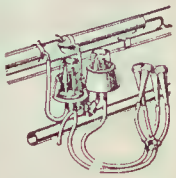

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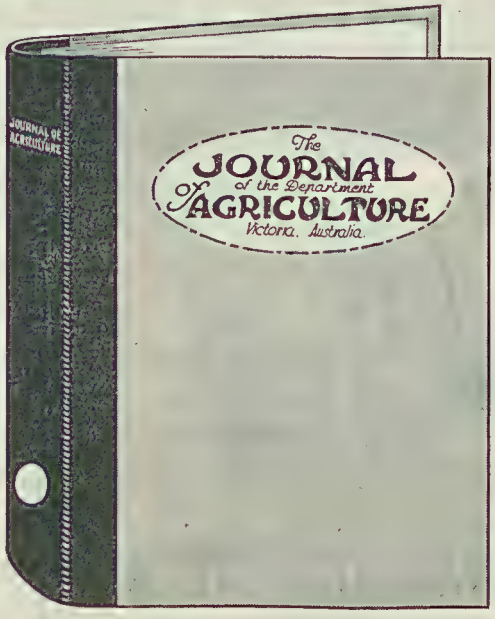

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